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ENGLISH FOR STUDENTS OF MATHEMATICS

2024

Рекомендовано Вченою радою механіко-математичного факультету КНУ імені Тараса Шевченка, протокол № 13 від 04 квітня 2024 року

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These assignments are for the English course for IV-year students of mathematics who decided to choose English as an elective (also sometimes referred to as an optional subject) within their degree. Students get a small leeway of choice between two options. It consists of 6 units based on topics of great interest to everyone studying mathematics. We hope this course will develop the communication skills one needs to succeed in a professional environment and will broaden the knowledge of the history of mathematics and will help to find out connections between mathematics and human progress. Students are offered a variety of discussion questions as an introduction to each unit. Students will extend their vocabulary by learning useful new words and phrases. Monolingual Glossary at the end of the course will also help to increase math vocabulary.

Students will read authentic articles from different authentic sources. Students will develop their reading skills. They will also be able to discuss the issues raised in the extracts from the books mentioned above. As a result they will become more accurate in their use of English at level B2+.

Навчальні завдання

для студентів математичних спеціальностей

(підготовка до заліку ДВС)

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Unit 1

Successful presentations

Before you read

Discuss these questions

- What makes a good presentation?
- Think of a good presentation you have ever seen. Why was it successful?
- A man who cannot speak well will never make a career. Do you agree with this statement?

Collaborative task

Match these events 1-8, which involve speaking in public, to definitions a-h. What kind of talks have you given? Who was your audience?

1) lecture	a) formal talk on a serious subject given to a group of people, especially students
2) briefing	b) an occasion when a teacher or expert and a group of people meet to study and discuss something
3) demonstration	c) a meeting of people to discuss and/or perform practical work in a subject or activity
4) seminar	d) a talk describing a product that can be bought
5) workshop	e) a talk to people of the same field, usually about your research
6) press conference	f) the act of showing someone how to do something or how something works
7) conference presentation	g) a meeting where information is given to someone just before they do something
8) commercial presentation	

	h) a meeting at which a person or organization makes a public statement and reporters can ask questions
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Reading and Information search

Preparing a good presentation is essential for effectively conveying your message to your audience. Here are some valuable tips and advice on how to prepare a presentation. Read them and decide which pieces of advice are the most important and the least for a successful presentation and explain why you think so.

Understand Your Audience:

Know your audience's background, interests, and level of familiarity with the topic. Tailor your content to their needs and expectations.

Define Your Purpose:

Clearly articulate the main goal of your presentation. What do you want your audience to learn or take away from your talk?

Create an Outline:

Organize your content into a structured outline. A typical structure includes an introduction, main points, and a conclusion.

Start with a Strong Opening:

Grab your audience's attention with a compelling opening. This can be a story, a surprising fact, a question, or a quote.

Develop Clear Main Points:

Focus on 2-5 key points or messages. Make sure they are well-researched, relevant, and easy to understand.

Use Visual Aids Wisely:

If using slides, keep them simple and uncluttered. Use visuals to support your message, not to replace it. Limit the amount of text on each slide.

Practice, Practice, Practice:

Rehearse your presentation multiple times. This will help you become more comfortable with the material and the flow of your talk.

Manage Your Time:

Stick to your allotted time. Practice your presentation within the time constraints to ensure you can cover your content effectively.

Engage Your Audience:

Encourage interaction and engagement. Ask questions, use anecdotes, or employ multimedia elements to keep your audience's attention.

Use Stories and Examples:

Stories and real-life examples can make your content more relatable and memorable.

Speak Clearly and Confidently:

Speak at a moderate pace, enunciate your words, and vary your tone and pitch. Maintain good eye contact with the audience.

Be Mindful of Body Language:

Use positive body language to convey confidence and openness. Avoid distracting habits like fidgeting or pacing.

Address Questions Effectively:

Be prepared to answer questions. If you don't know the answer, it's okay to admit it and offer to follow up later.

Create Handouts:

Consider providing handouts or supplementary materials for the audience to reference after the presentation.

Rehearse Under Presentation Conditions:

If possible, practice in the actual presentation space to get a feel for the environment and technical setup.

Get Feedback:

Seek feedback from peers or mentors. They can provide valuable insights and suggestions for improvement.

Anticipate Technical Issues:

Have a backup plan for technical issues, such as projector malfunctions or audio problems. Test your equipment in advance.

Dress Appropriately:

Choose attire that is suitable for the occasion and reflects your professionalism.

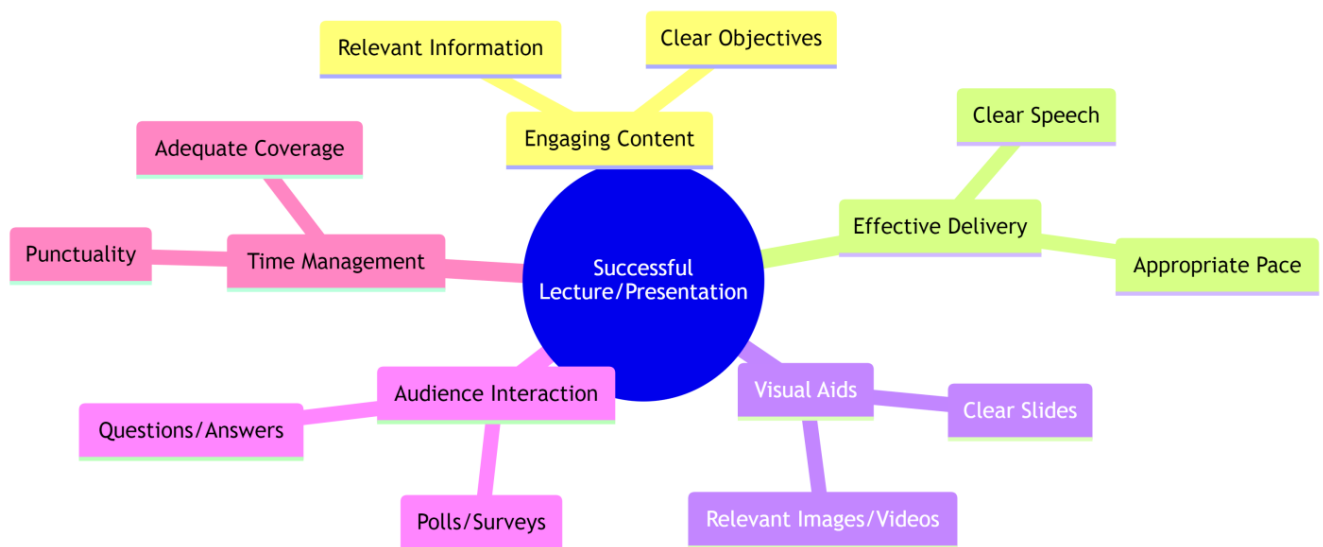
Be Passionate:

Show your enthusiasm for the topic. If you're genuinely excited, it will be contagious and capture your audience's interest.

Evaluate and Reflect:

After the presentation, reflect on what went well and what could be improved. Use this feedback to enhance future presentations.

Remember that practice and preparation are key to delivering a successful presentation. Tailoring your content to your audience and maintaining a clear, engaging, and organized structure will help you effectively convey your message.



Vocabulary

Match the following words used in the previous text with their definitions.

- | | |
|-------------------------|--|
| 1) tailor to(v)
type | a) clothes, especially of a particular or formal |
| 2) compelling(adj) | b) to pronounce clearly |
| 3) uncluttered (adj) | c) making continuous movements |
| 4) enunciate(v) | d) not containing different parts |
| 5) fidgeting (adj) | e) making you want to listen |

6) attire (n)

f) to improve the quality

7) contagious (adj)

g)to adjust sth to suit a particular need

8) enhance (v)

h) moving easily from one person to another

Discussion point

What if you were to give a short presentation on how to make a good presentation.

What would you say?

Word Formation

Read the presentation about Extreme Weather given below. Use the word given in capitals at the end of some of the lines to form a word that fits in the space in the same line

Extreme Weather is packed with facts about the great forces of nature and is a (1) illustrated science book by BEAUTY the meteorologist, H. Michael Mogil. The aim of the book is to present enough knowledge to understand the many (2) of the debate COMPLEX about climate change.

Mogil is alarmed about the way the public has been (3)on this issue, LEAD being pushed towards certain positions on climate change by the campaigning of (4) and the news media's need for a good. POLITICS story. He wants to demonstrate that climate change is an (5) CREDIBLE complicated issue, and that making overly simplistic (6) ASSUME will inevitably (7) ... our understanding. He therefore PAIR (8)..... emphasises that weather records are short, often REPEAT incomplete and tricky to compare. Mogil suggests that, in the distant past, changes in climate occurred in magnitudes far greater than in recent times. It is the (9) detail with which these recent events FINITE have been recorded that differentiates them from the past.

Over to you

1. Choose a subject you feel strongly about and prepare a short presentation on it taking into account the tips given above. Spend 10 minutes making some notes. The template below may help. Try to make your main points as graphic and dramatic as possible.

Presentation template. Work individually or with a partner. Use the template to develop a short presentation with a strong opening, a strong ending and three main stages in between. Make a note of: the main points you want to make; key topic vocabulary you think you may need; expressions that may help you at each stage of the presentation (e.g. I'd like to focus on..., Feel free to interrupt if you have any questions, I'll give a brief overview of..., To sum up,...); signpost language to transition from one stage to the next.(e.g. "To move on", "Turning to the question of...", Getting back to ...")

2. Work in two teams. You are members of a conference committee. You are going to organize a conference on the topic "Why Math is important?" As a group make a list of research problems to be discussed within different workshops or an information bulletin containing a brief summary of all the workshop discussion points to attract prospective participants.

The videos might help you <https://www.youtube.com/watch?v=KX608C2RZek>
<https://www.youtube.com/watch?v=7snnRaC4t5c>
<https://www.youtube.com/watch?v=a19A04HMTVo>

Web research task

Watch two films about secrets to great public speaking

https://www.ted.com/talks/chris_anderson_ted_s_secret_to_great_public_speaking?utm_campaign=tedsread&utm_medium=referral&utm_source=tedcomshare

<https://www.youtube.com/watch?v=V8eLdbKXGzk>

, note down the most interesting tips and make a short presentation.

Unit 2

The Shape of Logic

Before you read

1. Discuss these questions

- Is mathematics logically consistent?
- Can you name the mathematicians who contributed to Math Logic?
- What Logic does for us?

Vocabulary tasks

Key terms

Match these terms with their definitions.

- | | |
|------------------|--|
| 1) deduction | a) the simultaneous assertion of both the truth of a proposition and its denial. |
| 2) contradiction | b) division of the rational numbers into two (nonempty) sets such that every number of the first set (A) is less than every number of the other set (B). |
| 3) Dedekind cut | c) a situation in which an apparently reasonable assumption leads to an unreasonable conclusion. |
| 4) paradox | d) the process of reasoning from axioms, premises or assumptions, in logic or in mathematics, using accepted steps of reasoning. |
| 5) consistent | e) describing a “formal system in logic which is free from contradiction |

Reading tasks and Use of English

1. Read the text and fill in the gaps with the following words.

in any rigorous way ; that we all know how they behave ; of this axiomatic approach is; because of some underlying vagueness or ambiguity; reverse engineering of new concepts from; had neglected to ask what numbers were; to avoid logical pitfalls;

As the superstructure of mathematics grew ever larger, a small number of mathematicians began to wonder whether the foundations could support its weight. A series of foundational crises - in particular the controversies over the basic concepts of calculus and the general confusion about Fourier series - had made it clear that mathematical concepts must be defined very carefully and precisely (1)____ . Otherwise the subject's towers of deduction could easily collapse in logical contradictions, (2)_____ .

At first, such worries were focused on complicated, sophisticated ideas, such Fourier series. But slowly the mathematical world came to realize that very basic ideas might also be suspect. Paramount among them was the concept of a number. The dreadful truth was that mathematicians had devoted so much effort to the discovery of deep properties of numbers that they (3)_____ . And when it came to giving a logical definition, they didn't know.

Dedekind pointed out that apparently obvious properties of real numbers had never been proved (4)_____ . He proposed a way to fill these gaps, using what we now call *Dedekind cuts*. The idea was to start from an established number system, the rational numbers, and then to extend this system to obtain the richer system of real numbers. This kind of (5)_____ old ones has been widely used ever since.

Peano wrote down a list of axioms for whole numbers. He then defined the numbers 1, 2 and so on in terms of those axioms. A great advantage (6)_____ that it pins down exactly what we have to prove if we want to show, by some means or other, that whole numbers exist. We just have to construct some system that satisfies all of *Peano's axioms*. The meaning of number' is a surprisingly difficult conceptual and philosophical problem. It is made all the more frustrating by the fact (7)_____ , but not what they are.

(an excerpt from the book The story of mathematics by Ian Stewart)

2. Read the text below and think of the word which best fits each gap. Use only one word in each gap.

Hilbert discovered logical flaws (1) ___ in Euclid's axiom system, and realized that these flaws (2) ___ arisen because Euclid had (3) ___ misled by his visual imagery. Because he knew that a line was (4) ___ long thin object, a circle was (5) ___ and a point was a dot, he had inadvertently assumed certain properties of these objects, (6) ___ stating them as axioms. After several attempts, Hilbert (7) ___ forward a list of 21 axioms and discussed their role in Euclidean geometry in his 1899 "Foundations of Geometry" Hilbert maintained (8) ___ a logical deduction must be valid, independently of the interpretation imposed (9) ___ it. Anything that relies (10) ___ some particular interpretation of the axioms, but fails (11) ___ other interpretations, involves a logical error. It is this view of axiomatics, (12) ___ than the specific application to geometry, that (13) ___ Hilbert's most important influence (14) ___ the foundations of mathematics. In (15) ___, the same point of view also influenced the content of mathematics, (16) ___ making it much easier - and (17) ___ respectable - to invent new concepts (18) ___ listing axioms for them. Much of the abstraction of early 20th century mathematics stemmed (19) ___ Hilbert's viewpoint. It is often said that Hilbert advocated the idea that mathematics is a meaningless game (20) ___ with symbols, but this overstates his position. His point was that in (21) ___ to place the subject on a firm logical basis, you have to think about it (22) ___ if it is a meaningless game played with symbols. All else is irrelevant (23) ___ the logical structure. But no one (24) ___ takes a serious look at Hilbert's mathematical discoveries, and his deep commitment (25) ___ the subject, can reasonably deduce that he thought he was playing a meaningless game.

After his success in geometry, Hilbert now (26) ___ his sights on a far more ambitious project: to place the whole of mathematics on a sound logical footing. He followed the work of the leading logicians closely, and developed an explicit programme to sort (27) ___ the foundations of mathematics (28) ___ and for all. As well as proving that

mathematics was free of contradictions, he also believed that in principle every problem could be solved - every mathematical statement could (29)___ be proved or disproved. A number of early successes convinced him that he was heading (30)___ the correct path, and that success was not far away. (*an excerpt from the book The story of mathematics by Ian Stewart*)

Word search 3. Find a word in the text above that means the same as the words and phrases below:

- 1) a mistake
- 2) to make someone believe something
- 3) not done intentionally
- 4) to make an activity continue in the same way
- 5) to force to accept
- 6) to express support for a particular idea
- 7) not important in a particular situation
- 8) a firm decision to do sth
- 9) a big difference between two things
- 10) to persuade

Reading 4. Read the text and answer the questions given below:

After Gödel, mathematical truth turned out to be an illusion. What existed were mathematical proofs, the internal logic of which might well be faultless, but which existed in a wider context - foundational mathematics – where there could be no guarantee that the entire game had any meaning at all. Gödel did not just assert this: he proved it. In fact, he did two things, which together left Hilbert's careful, optimistic programme in ruins. Gödel proved that if mathematics is logically consistent, then it is impossible to prove that. Not just that he could not find a proof, but that no proof exists. So, remarkably, if you do succeed in proving that mathematics is consistent, it immediately follows that it's not. He also proved that some mathematical statements can neither be proved nor disproved. Again, not just that he personally could not

achieve this, but that it is impossible. Statements of this type are called undecidable. He proved these statements initially within a particular logical formulation of mathematics, that adopted by Russell and Whitehead in their Principia Mathematica. To begin with, Hilbert thought that there might be a way out: find a better foundation. But as the logicians studied Gödel's work, it quickly became apparent that the same ideas would work in any logical formulation of mathematics, strong enough to express the basic concepts of arithmetic. An intriguing consequence of Gödel's discoveries is that any axiomatic system for mathematics must be incomplete: you can never write down a finite list of axioms that will determine all true and false theorems uniquely. There was no escape: Hilbert's programme cannot work. It is said that when Hilbert first heard of Gödel's work he was extremely angry. His anger may well have been directed at himself, because the basic idea in Gödel's work is straightforward. (The technical implementation of that idea is distinctly difficult, but Hilbert was good with technicalities.) Hilbert probably realized that he should have seen Gödel's theorems coming. Russell demolished Frege's book with a logical paradox, the paradox of the village barber who shaves everyone who does not shave himself: the set of all sets that are not members of themselves. Gödel demolished Hilbert's programme with another logical paradox, the paradox of someone who says: this statement is a lie. For in effect Gödel's undecidable statement - on which all else rests - is a theorem T that states: 'this theorem cannot be proved'. If every theorem can either be proved, or disproved, then Gödel's statement T is contradictory in both cases. Suppose T can be proved: then T states that T cannot be proved, a contradiction. On the other hand, if T can be disproved, then the statement T is false, so it is wrong to state that T cannot be proved. Therefore T can be proved, another contradiction. So the assumption that every theorem can either be proved or disproved tells us that T can be proved if and only if it cannot be proved. *(an excerpt from the book The story of mathematics by Ian Stewart)*

1. How did Gödel's incompleteness theorems challenge the notion of mathematical truth as an absolute and provable concept?

2. What are the key aspects of Gödel's proofs that led to the conclusion that mathematics is inherently incomplete?
3. How did Gödel's work impact Hilbert's program in foundational mathematics, and why was Hilbert initially angry upon hearing about it?
4. Can you explain the concept of undecidable statements in the context of Gödel's theorems, and why they are significant in the philosophy of mathematics?
5. What is the paradoxical nature of Gödel's undecidable statement T, and how does it demonstrate the limitations of traditional notions of provability in mathematics?
6. What were some attempts to find a way out of Gödel's results, such as finding a better foundation for mathematics, and why did they ultimately fail?

Use of English

5. Read the text given below. Think of the word which best fits each gap. Use only one word in each gap.

Russell's Paradox

A less formal version of the paradox proposed (1)___ by Russell is the village barber, (2)___ shaves everyone who (3)___ not shave themselves. Who shaves the barber? If he does shave himself (4)___ by definition he (5)___ shaved by the village barber - himself! If he does not shave himself, then he (6)___ shaved by the barber - which, again, is (7)___.

Aside from various cooks - the barber is a woman, for instance - the only possible

conclusion is that no (8)___ barber exists. Russell reformulated this paradox in (9)___ of sets. Define a set X to consist (10)___ all sets that are not members of themselves. Is X a member of itself, or not? If it is not, then by definition it belongs (11)___ X - itself. If it is, a member of itself, then like all members of X, it is not a member of itself. This

time there is no way (12)___ - female sets are not yet part of the mathematical enterprise. *(an excerpt from the book The story of mathematics by Ian Stewart)*

Word search 6. Read the text and find words or expressions in the text that mean the following.

- 1) an uncertain situation (n)(para1)
- 2) not able to be achieved (adj) (para1)
- 3) a system that has been established for a long time (n) (para 2)
- 4) to examine something detail (v)(para 3)
- 5) different from what is usual (adj) (para 4)
- 6) the fact of proving that what someone said was right, after other people thought it was wrong (n) (para 4)
- 7) agreement or harmony of parts to one another (n) (para 4)
- 8) existing as a natural part of something (adj) (para 4)

Gödel's theorems changed the way we view the logical foundations of mathematics. They imply that currently unsolved problems may have no solution at all -neither true nor false, but in the limbo of undecidability. And many interesting problems have been shown to be undecidable. However, the effect of Gödel's work has not, in practice, extended much beyond the foundational area where it took place. Rightly or wrongly, mathematicians working on the Poincaré conjecture, or the Riemann hypothesis, spend their time either looking for proofs or disproofs. They are aware that the problem may be undecidable, and might even look for a proof of undecidability if they could see how to get started. But most known undecidable problems have a self-referential feel to them, and without that, a proof of undecidability seems unattainable anyway.

As mathematics built ever more complicated theories on top of earlier ones, the superstructure of mathematics began to come to pieces because of unrecognized assumptions that turned out to be false. In order to shore up the entire edifice, serious work was needed on the foundations.

The subsequent investigations delved into the true nature of numbers, working backwards from complex numbers to reals, to rationals and then to whole numbers. But the process did not stop there. Instead, the number systems themselves were reinterpreted in terms of even simpler ingredients, sets.

Set theory led to major advances, including a sensible, though unorthodox, system of infinite numbers. It also revealed some fundamental paradoxes related to the notion of a set. The resolution of these paradoxes was not, as Hilbert hoped, a complete vindication of axiomatic mathematics, and a proof of its logical consistency. Instead, it was a proof that mathematics has inherent limitations, and that some problems do not have solutions. The upshot was a profound change in the way we think about mathematical truth and certainty. It is better to be aware of our limitations than to live in a fool's paradise. *(an excerpt from the book The story of mathematics by Ian Stewart)*

Discussion point

Work in two teams. You are members of a conference committee. You are going to organize a conference on the topic “Gödel’s theorems and their role in the logical foundations of mathematics.” As a group make a list of research problems to be discussed within different workshops or an information bulletin containing a brief summary of all the workshop discussion points to attract prospective participants

Over to you

1. Summarize the main points from the texts in your own words.
2. Write a short report on.
3. Work in two teams. You are members of a conference committee. You are going to organize a conference on the topic “What logic does for us”. As a group make a list of research problems to be discussed within different workshops or an information bulletin containing a brief summary of all the workshop discussion points to attract prospective participants.

Web research task

Watch a documentary “Fuzzy Logic”, note down the most interesting facts about it and make a short presentation.

Listen to the Lecture “Mathematical Puzzles and Paradoxes” delivered at Gresham College by Sarah Hart, Professor of Geometry. Choose one puzzle or paradox and make a short presentation.

https://www.gresham.ac.uk/watch-now/maths-puzzles?utm_source=google&utm_medium=cpc&utm_campaign=19975578621&utm_content=148918386660&utm_term=&gad_source=1&gclid=Cj0KCQjwxeyxBhC7ARIsAC7dS38LE5_nP_6Fi7VVK045obSw_-Dgn6MQpQd7o-Z0eIXziTZVNUqEww8aAo2xEALw_wcB

Unit 3

Game Theory

Before you start discussing Game Theory

- What is Game Theory?
- What is strategic interdependence?
- How is Game Theory applied in Economics, and what are some examples of economic situations where game theory provides valuable insights?
- In what ways is Game Theory used in Political Science, particularly in analyzing voting behavior, strategic interactions among political entities, and negotiation strategies?

Watch Game Theory 101 Full Course by William Spaniel choose one video from the course and make a short presentation.

https://www.youtube.com/watch?v=NSVmOC_5zrE&list=PLKI1h_nAkaQoDzI4xDIXzx6U2ergFmedo

<https://gametheory101.com/courses/game-theory-101/>

Before you read

- How does game theory help in finding optimal strategies for players in situations where both players aim to play optimally?
- How has game theory been applied in real-world scenarios, such as in business decision-making or international relations?
- What are some limitations or challenges associated with applying game theory to complex human interactions and decision-making processes?
- How does game theory contribute to our understanding of cooperative and competitive behaviors among individuals and groups?

Reading and Information Search

Scan the text to find the following:

- Where can early ideas of game theory be traced back to, according to the text?
- When did game theory come of age, and who were the key figures involved in its development during that time?
- Why did John von Neumann leave Hungary, and what role did he play in advancing game theory?
- When was the book "Theory of Games and Economic Behavior" published, and what significance does it hold in the history of game theory?

A mathematical formalism used to study human games, economics, military conflicts, and biology. The goal of game theory is to find the optimal strategy for one player to use when his opponent also plays optimally. A strategy may incorporate randomness, in which case it is referred to as a mixed strategy. Early ideas of game theory can be found in writings throughout history as diverse as the Bible and works by René Descartes, Sun Tzu (author of the 2,400-year-old *The Art of War*), and Charles Darwin. The basis of modern game theory is an outgrowth of several books that deal with related subjects such as economics and probability. These include Augustin Cournot's *Researches into the Mathematical Principles of the Theory of Wealth* (1838), which gives an intuitive explanation of what would eventually be formalized by John Nash as *Nash equilibrium*; Francis Edgeworth's *Mathematical Psychics*, which explored the notion of competitive equilibria in a two- type (or two-person) economy; and Emile Borel's *Algebre et calcul des probabilites* (1927), which gave the first insight into so-called mixed strategies. Game theory finally came of age through the efforts of two European immigrants to the United States working at the Institute of Advanced Studies in Princeton. Around 1940, the idea of the utility function was taken up by John von Neumann, who had been forced to flee his native Hungary when the Nazis invaded, and the economist Oskar Morgenstern (1902–1976), who had left Austria because he

loathed the National Socialists. In Princeton the two immigrants worked together on what they initially thought would be a short paper on the theory of games, but that kept growing until it finally appeared in 1944 as an opus of 600 pages with the title (*an excerpt from The universal book of mathematics : from abracadabra to Zeno's paradoxes by Darling David*)

Match these terms with their definitions

- | | |
|---------------------|--|
| 1) categorical game | a) A game in which each player has a finite number of moves and a finite number of choices at each move. |
| 2) finite game | b) A game that allows a tie when played properly by both players. |
| 3) futile game | c) A game in which a tie is impossible. |
| 4) impartial game | d) A game for which each player has a different set of moves in any position. |
| 5) mixed strategy | e) An $m \times n$ matrix that gives the possible outcome of a two-person zero-sum game when player A has m possible moves and player B has n moves. |
| 6) partisan game | f) A game in which the possible moves are the same for each player in any position. |
| 7) payoff matrix | g) A game in which players make payments only to each other. One player's loss is the other player's gain, so the total amount of "money" available is constant. |
| 8) strategy | h) A set of moves that a player plans to follow while playing a game. |

- 9) zero-sum game i) A collection of moves together with a corresponding set of weights which are followed probabilistically in the playing of a game

Reading and Use of English


You are going to read a newspaper article about Game Theory. Seven paragraphs have been removed from the extract. Choose from the paragraphs (A-F) the one which fits each gap (1-5). There is one extra paragraph which you do not need to use.

The idea of business as a game, in the sense that a move by one player sparks off moves by others, runs through much strategic thinking. It is borrowed from a branch of economics (game theory) in which no economic agent (individual or corporate) is an island, living and acting independently of others.

In sectors where firms compete fiercely for market share and customer loyalty, this stylised progression of moves closely parallels actual behaviour. Few firms nowadays think about strategy without adding a bit of game theory. For John von Neumann and Oskar Morgenstern, the two economists who developed the idea, strategy was “a complete plan: a plan which specifies what choices [the player] will make in every possible situation”.

1. 

The language of business is scattered with references to games. Regulators try to make sure that companies operate on a “level playing field”, and competition is, according to at least one dictionary, “a series of games”. Business games that have enjoyed (sometimes brief) popularity include the following

- **The end game.** This is a strategy for a product that seems to be on its last legs. Should the company bleed it for all it is worth before it dies? 

- **The croquet game.** In “The Change Masters”, Rosabeth Moss Kanter wrote: I think the game that best describes most businesses today is the croquet game in “Alice in Wonderland”. 3.

- **The win-win game.** This is a game where both parties end up as winners; 4.

- **The zero-sum game.** This is shorthand for the idea that in every game, whether in business or on the sports field, the value of the winner's gains and the loser's losses is equal. In such games there is no incentive to co-operate with opponents because every inch given to them is an inch lost. The idea of the zero-sum game is modified by the introduction of the **variable-sum game** played. Hence, for instance, companies that are fighting for market share are playing a zero-sum game if they see that market as fixed. 5.

A In that game nothing remains stable for very long. Everything is changing around the players. Alice goes to hit a ball, but her mallet is a flamingo. Just as she's about to hit the ball, the flamingo lifts its head and looks in another direction. That's just like technology and the tools that we use.

B But if the market is continually expanding (or if the companies redefine it so that it is), the players are playing a game in which they can have a declining share of a bigger cake and still see their businesses grow.

C Seeing business life as a never-ending series of games, each of which has a winner and a loser, can be a handicap. In business negotiations, for example, with external suppliers or customers, or with trade unions or colleagues, it can be unhelpful if participants see it only in terms of a victory or a loss. For that way one party has to walk away feeling bad about the outcome. In some non-western cultures the aim is different. The negotiation process is steered towards a win-win outcome, one with which both parties can be reasonably content.

D Or should it introduce an aggressive pricing policy aimed at forcing its competitors out of business and allowing it to continue in a much reduced niche market? In her book “Managing Maturing Businesses”, Kathryn Harrigan, a professor at Columbia Business School, argues that end games can be highly profitable. She writes: “The last surviving player makes money serving the last bit of demand, when the competitors drop away.”

E for example, a merger between two companies where synergy genuinely allows them to become more than the sum of their parts.

F The players all played at once without waiting for turns, quarrelling all the while, and fighting for the hedgehogs; and in a very short time the Queen was in a furious passion, and went stamping about, and shouting 'Off with his head!' or 'Off with her head!' about once in a minute.

Reading. Read the following introduction to the lecture “The Maths of Game Theory” delivered by Professor Sarah Hart at Gresham College and think of think of the word which best fits each space. Use only one word in each space.

There are a lot of situations that can arise in real life around buying, selling and other economic activity. In “price war”, the question is, if I’m running a company, should I lower my prices (1)___ increase market share – the lower price means (2)___ profit per item, but if I’m selling many (3)___ items I’m going to increase overall profit. So what should I do? In “best coffee in town”, café owners at a tourist hotspot can charge very high (4) ___ to tourists who are never going to return anyway, and can’t try all the cafés to find (5) ___ where the cheapest and (6) ___ coffee is, but if they charge (7)___ much, the locals (8)___ stay (9) ___. So what’s the best price to set? Finally, in an auction, especially a sealed bid or silent auction, what price should you bid to avoid (10) ___ disappointed? In all these cases, the decisions you make (11) ___ affected by the decisions of others, just like in a game of chess. Analysing situations (12)___ these mathematically by thinking of them as games, with players and strategies, is what we call game theory. I’m going to show you how some simple mathematical ideas can help

us understand “games” like these, which allows us both (13)___ find good strategies, but also to design the rules of the game (14)___ get a better outcome.

Listening and Sentence completion

Listen to the lecture “ The Maths of Game Theory” delivered by Professor Sarah Hart at Gresham College and complete the sentences with a word or short phrase.

<https://www.gresham.ac.uk/watch-now/game-theory>

In Prisoner’s Dilemma the best outcome can only be achieved through (1)____. David Blackwell, had an interesting comment about the Prisoner’s Dilemma: to cooperate is (2)___ and to double-cross is (3)___ with bigger and bigger weapons. That takes a lot of resources and we would both be better off (4) ____. But each is afraid that if he throws away his weapons, the other one will not and he will be at a great (5) ____.” The duel is an example of a two-person (6) ___ game, and one of the first major results in game theory is about such games. It was Neumann’s Minimax Theorem. This theorem is illustrated by the simple example is illustrated in the lecture , and it’s to do with (7)____. The duel problem is reminiscent of a Dutch-style (8)____, when a high price is initially set and then is brought down in increments until someone bids. The last discussed problem is the (9)_____.

Discussion point

Your Mathematics and Mechanics Faculty is trying to choose a new course for the coming year. The dean’s office narrowed the list of suggestions down to two possibilities. You are part of the student committee that has been asked to recommend one of the courses.

Course 1.Game Theory in Economics

Course 2. Discuss these courses in small groups of three or four. Choose a person from your group for a brief summary of your discussion.

Information search

Read the article “The Game Theory of Soccer Penalty Kicks’ (by William Spaniel Associate Professor, Department of Political Science, University of Pittsburgh) where optimal strategy for the striker and one for the goalkeeper is analyzed and make a short presentation

<https://williamspaniel.com/2014/06/12/the-game-theory-of-soccer-penalty-kicks/>

Over to you

1. Listen to the lecture “Turing and Neumann” delivered by Professor Raymond Flood at Gresham College, note down the most interesting facts about Game theory discussed in the lecture and make a short presentation.

<https://www.gresham.ac.uk/lectures-and-events/turing-and-von-neumann>

2. Work in two teams. You are members of a conference committee. You are going to organize a conference on the topic “ The role of Game Theory in Economics”. As a group make a list of research problems to be discussed within different workshops or an information bulletin containing a brief summary of all the workshop discussion points to attract prospective participants.

Web research task

Watch a film “What Game Theory Reveals About Life, The Universe, and Everything”, note down the most interesting facts mentioned in it and make a short presentation.

<https://www.youtube.com/watch?v=mScpHTIi-kM>

Listen to the lecture “ The Maths of Game Theory delivered by Professor Sarah Hart at Gresham College and complete the sentences with a word or short phrase.

<https://www.gresham.ac.uk/watch-now/game-theory>

Unit 4.

Artificial Intelligence

A Before you read

1. Discuss these questions

- What is AI? For someone on the street? For an expert in deep learning?
- Stephen Hawking has said that real artificial intelligence will mean the end of mankind. Is that a real threat? Are there limits to what a silicon brain might do?
- In the long run, in an Internet society, it is claimed, we will neither need nor want doctors, teachers, accountants, architects, the clergy, consultants, lawyers, and many others, to work as they did in the 20th century. - Is this true?

Vocabulary tasks

Key terms

- | | |
|------------------------|--|
| 1. deep learning | a) a type of machine learning that uses many layers of data processing |
| 2. machine learning ML | b) a mathematical representation of text |
| 3. neural network | c) the process of computers improving their own ability to perform tasks by analyzing new data |
| 4. a back-room task | d) an important task that has been made in a secret, dishonest way |
| 5. a dataset | e) the fact of preferring a particular object or thing |
| 6. bias | f) a state of confusion and disorderliness |
| 7. messiness | g) a collection of data |

1. Reading and Use of English

1. Read the text and fill in the gaps with the following words.

- can make remarkably accurate recommendations about movies;
- fraudulent use of credit and debit cards;
- has often been aide;
- have already processed photographs;
- are used for purposes that include the design of new pharmaceuticals;
- supports the analysis of data from the Large Hadron Collider at CERN and the search for interesting astronomical objects;
- being used in many applications;
- has made the greatest recent advances;
- is being used to predict where crime is likely to be committed;
- the neural network;

Machine Learning Machine learning (ML) is the subset of artificial intelligence research that (1)____. At the simplest level, machine learning systems work by analysing very large quantities of data and determining the relationships between data objects. This process may be guided by humans – for example, image recognition (2)_____ by training the systems on large quantities of image data that has been tagged to say what the image is. This is how the apps on social media sites can name individuals in new photographs – they (3)_____ of that individual that have had a name attached. Unguided machine learning searches for correlations in datasets: given a dataset that contains the movie preferences of enough people, a machine learning system (4)_____ that you will enjoy based on just a few ratings that you provide about movies that you have seen. These recommender systems are becoming commonplace on e-commerce sites.

Machine learning is (5)_____. In banking, ML is used (for example) in the systems that detect suspected (6)_____, in systems to detect possible money laundering, in voice recognition systems, and in the on-line “chatbots” that provide customer support and that may provide routine financial advice. In healthcare, ML systems (7)____, medical diagnosis and mental health. ML is increasingly used to extract information from the large quantities of data generated in manufacturing. In science, ML (8)____. In law enforcement, ML (9)____, in a process known as “predictive policing”. ML will undoubtedly be used to automate many routine back-room tasks across more and more sectors of the economy. The most widely used form of machine learning is (10)____, a computer simulation of a very simplified version of how a biological brain is believed to function.

2. Read the text. Think of the word which best fits each gap. Use only one word in each gap.

There are some problems that researchers have not (1)___ adequately solved. The problems include: • Can we create machine learning systems (2)___ workings, or outputs, can be understood or interrogated by human users, so (3)___ a human-friendly explanation (4)___ a result can be produced? • Can we create (5)___ advanced, and (6)___ accurate, methods of verifying machine learning systems so that we can have (7)___ more confidence in their deployment? • What are the technical solutions that (8)___ maintain the privacy of datasets. While allowing them (9)___ be used in new ways by different users? • How can real-world data be curated (10)___ machine-usable forms, addressing ‘real-world’ messiness and potential systemic – or social – biases? • How can machine learning methods discover cause–effect relationships, in (11)___ to correlations? • How do we design machine learning systems (12)___ that humans can work with them safely and effectively? • How do we ensure machine learning systems are not vulnerable (13)___ cyber-attack? Alan Turing had already recognised that the creators of machine learning systems would probably be (14)___ to understand their behaviour. He wrote: An important feature of a learning machine is that (15)___ teacher will often be very largely ignorant of quite what is going on inside, although he may

still be able to some (16)__ to predict his pupil's behaviour. (*an excerpt the lecture Artificial Intelligence delivered by professor Martyn Thomas CBE, 13 June 2017*)

2. Reading & Word study

Read the text, answer the questions given below and find words or expressions in the text that mean the following.

1. to increase importance (n) (para 1)
2. to encourage (v) (para 2)
3. to improve the quality (v) (para 2)
4. the ability of a system to grow faster (n) (para 2)
5. convincing (adj) (para 2)
6. essential, necessary (adj)(para 5)
7. to take care, protect (v) (para 6)

Empowering Education: The Synergy of AI and Human Teaching

Artificial Intelligence in teaching offers several distinct advantages. It allows for the personalization of learning experiences, tailoring content to the specific needs and pace of individual students. Moreover, AI-powered educational platforms have the potential to scale up and reach learners worldwide, overcoming geographical constraints. Lastly, AI enhanced education ensures accessibility for diverse learners, including those with disabilities, by providing adaptable resources and personalized support.

Personalized Learning

Personalized learning, a key benefit of AI in education, empowers students to learn at their own pace and style. AI algorithms analyze student data to identify areas of improvement and offer customized content and exercises. This tailored approach not only enhances student engagement but also accelerates the learning process, resulting in more effective knowledge retention and skill development. Scalability is another compelling advantage of AI in teaching. Traditional education models are limited by the number of teachers available, but AI-enabled platforms can reach millions of students simultaneously. This scalability ensures that quality education is accessible to a broader

population, including underserved regions, and can adapt to surges in demand, such as during pandemics.

Accessibility

Artificial Intelligence makes education more accessible than ever before. It accommodates various learning styles, offering multiple formats and serves to the diverse needs of students. Additionally, AI can provide support for students with disabilities, whether it's through adaptive content, real-time translation, or assistance with specific learning challenges, making education truly inclusive.

The Limitations of AI in Teaching

Despite the significant advantages, there are limitations to AI in teaching. AI lacks emotional understanding and empathy, which are vital in the learning process. Human teachers can offer emotional support, mentorship, and guidance that AI cannot replicate. Furthermore, the potential displacement of teaching jobs by AI raises ethical and economic concerns, which must be addressed.

The Role of Human Teachers

Human teachers play an indispensable role in education. They provide emotional support, guidance, and mentorship that AI cannot replace. They have the ability to adapt to the unique needs of students in real-time, offering a human touch that fosters critical thinking, creativity, and character development.

Finding the Balance

To create an effective and holistic educational experience, it's crucial to strike a balance between AI and human teaching. AI can handle repetitive tasks, personalized content delivery, and data analysis, allowing teachers to focus on what they do best: inspiring, motivating, and nurturing the intellectual and emotional growth of students. The integration of AI and human teachers is the future of education, where each complements the strengths of the other, ultimately benefiting students and society as a whole.

1. What are some key advantages of AI in education, according to the text?
2. How does personalized learning contribute to the effectiveness of education, and what role does AI play in enabling personalized learning experiences?

3. Discuss the scalability aspect of AI in education and how it addresses challenges related to traditional education models.
4. In what ways does AI enhance accessibility in education, especially for diverse learners and those with disabilities?
5. What are some limitations of AI in teaching, as outlined in the text?
6. How does the role of human teachers complement the capabilities of AI in education, particularly in terms of emotional support, mentorship, and guidance?
7. What is emphasized as the key to creating an effective and holistic educational experience in the text, and why is finding a balance between AI and human teaching essential?

Discussion point

1. What are the advantages of using machine translation with natural language?

One of the main advantages of machine translation is speed. Another advantage is the lower cost of machine. Technical documents generally have any specialized words and phrases, and a human translator will often need to use a dictionary to understand these. In machine translation, these special words and phrases can be translated automatically and without mistakes. However, there are some disadvantages to machine translation. The first of these is the quality of the translation. Machine translators may not be able to recognize the different types of texts, so the translation may sound strange or, in some cases, be totally wrong. Another disadvantage is the range of languages which machine translation can provide, Most machine translation software will support popular languages such as English, Spanish, Mandarin and Arabic, but less popular languages are not always supported. A final disadvantage of machine translation is that it does not do a good job with creative texts, such as novels or poems. These rely on a knowledge of the culture of a country, as well as its language. For this type of translation, a human translator is essential.

2. Discuss the following most common questions about the role AI in our life:

1. What are some key milestones in the development of artificial intelligence, and how have they shaped the field over time?
2. How do machine learning and deep learning differ, and what are their respective roles in AI applications?
3. What are some ethical considerations surrounding the use of AI, particularly in areas like privacy, bias, and job displacement?
4. How does natural language processing (NLP) enable AI systems to understand and generate human language, and what are some challenges in this field?
5. What are the current limitations of AI technology, and what areas of research are focused on overcoming these limitations?
6. How do AI systems learn from data, and what are the implications of data quality and quantity on the performance of AI algorithms?
7. What role does AI play in industries such as healthcare, finance, and transportation, and what are some potential future applications of AI in these sectors?
8. How are AI systems tested and evaluated for reliability, fairness, and safety, and what measures are taken to mitigate potential risks associated with AI deployment?

Use of English

3. Read the answers to the questions . Each answer contains two mistakes, find and correct them.

1. Key milestones in AI development include the creation of the first artificial neural network in the 1940s, the development of expert systems in the 1970s and 1980s, and the resurgence of AI driven by machine learning and deep learning algorithms in the 21st century. This milestones have shaped AI by advancing it's capabilities and expanding its applications across various domains.
2. Machine learning involve algorithms that enable systems to learn from data and do predictions or decisions without being explicitly programmed. Deep learning is a subset of machine learning that uses neural networks with multiple layers to learn hierarchical representations of data. Machine learning is used for tasks like image recognition and recommendation systems, while deep learning excels in areas such as computer vision and natural language processing.

3. Ethical considerations in AI include concerns about data privacy, algorithmic bias, and the impact of AI in employment. Issues such as the collection and use of personal data, fair in algorithmic decision-making, and the potential for job displacement due to automation are topics of ongoing debate and regulation in the AI community.
4. Natural language processing (NLP) enables AI systems in understand and generating human language by applying techniques like sentiment analysis, named entity recognition, and machine translation. Challenges in LP include handling ambiguity, context understanding, and maintaining linguistic diversity in language models.
5. Current limitations of AI technology includes difficulties in generalizing from limited data, interpretability of deep learning models, and ethical considerations in AI deployment. Research efforts are focused in improving AI robustness, developing explainable AI techniques, and addressing biases and fairness in AI systems.
6. AI systems learn from data through algorithms such as supervised learning, unsupervised learning, and reinforcement learning. The quality and quantity of data impact the performance of AI algorithms, with challenges related in data bias, data privacy, and data scarcity with certain domains.
7. AI plays the significant role in industries such as healthcare (e.g., medical imaging diagnosis), finance (e.g., fraud detection), and transportation (e.g., autonomous vehicles). Future applications of AI may includes personalized medicine, automated financial advisory services, and intelligent transportation systems.
8. AI systems are testing and evaluating for reliability, fairness, and safety using techniques such as cross-validation, fairness audits, and adversarial testing. Measures to mitigate risks associated with AI deployment include transparency in AI decision-making, accountability frameworks, and regulatory oversight of AI applications.

Over to you

Listen to the Lecture “Artificial Intelligence” delivered by Professor Martyn Thomas CBE at Gresham College. Summarize the main points from the lecture in your own words.

<https://www.gresham.ac.uk/watch-now/artificial-intelligence>

1. Work in two teams. You are members of a conference committee. You are going to organize a conference on the topic “Artificial Intelligence vs Human Teaching”. As a group make a list of research problems to be discussed within different workshops or an information bulletin containing a brief summary of all the workshop discussion points to attract prospective participants.

Web research task

1. Listen to the Lecture “Artificial Intelligence” delivered by Professor Martyn Thomas CBE at Gresham College. Summarize the main points from the lecture in your own words.

<https://www.gresham.ac.uk/watch-now/artificial-intelligence>

2. Watch documentaries Holy Grail of AI; AI Self Improvement (Computerphile), note down the most interesting facts about them and make a short presentation.

<https://www.youtube.com/watch?v=tlS5Y2vm02c&list=PLzH6n4zXuckquVnQ0KIMDxyT5YE-sA8Ps>

<https://www.youtube.com/watch?v=5qflgCiYlfY&list=PLzH6n4zXuckquVnQ0KIMDxyT5YE-sA8Ps&index=3>

Unit 5

Deepfakes and Blockchain Technology

Before you read

Discuss these questions

- Why are deepfakes real problem?
- What is blockchain technology, and how does it work in the context of cryptocurrencies and decentralized networks?
- What are some potential applications of blockchain technology beyond cryptocurrencies, such as supply chain management, digital identity, and smart contracts?

Key terms

Match these terms with their definitions.

- | | |
|-------------------------------|---|
| 1) Deepfake | a) a record-keeping system where the data entered can't be altered, tampered with, or deleted. |
| 2) Blockchain technology | b) a type of stablecoin cryptocurrency |
| 3) An immutable ledger | c) an advanced database mechanism that allows transparent information sharing within a business network |
| 4)USDC | d) a video or sound recording that replaces someone's face or voice with that of someone else, in a way that appears real |
| 5)Ethereum | e)a cryptocurrency that operates on its own blockchain and aims to facilitate fast and secure transactions globally |
| 6)Worldcoin
cryptocurrency | f)a decentralized blockchain platform and |

Reading tasks and Use of English

Read the text and fill in the gaps with the following words:

to leverage public key cryptography;
that falsely depicts them in compromising or inappropriate situations, leading to personal and professional consequences;
PhotoShop and image generators like Stable Diffusion to incorporate public key cryptography mechanisms;
to agree to a standard watermark solution;
on integrating public key signing with real-world identity verification;
to avert the system and recreate another on-chain identity;
to create realistic-looking videos of public figures saying or doing things they never did;

Deepfake technology - videos, audio or images that have been manipulated by AI to impersonate real people - has advanced so much in recent years that it now poses a real security threat to businesses, political outcomes, and societal beliefs. These convincing creations have the capacity to substitute a person's appearance and voice, raising concerns about their potential for misuse in spreading misinformation, *perpetrating fraud*, and other malicious activities.

The rise of deepfakes is a *formidable* threat that raises profound concerns across various domains. Deepfakes can be used (1)_____. This can lead to the spread of false information and contribute to the problem of fake news. Deepfakes and AI-generated content are often created by *leveraging* Intellectual Property such as songs and movies. This can lead to copyright *infringement*, which poses ethical concerns and potential economic losses for those affected. Individuals can be targeted with deepfake content (2)____. Beyond tarnishing personal reputations, this poses severe emotional and psychological risks for those targeted. Deepfakes can be used for malicious purposes, such as creating realistic fake identities for unauthorized access to secure systems or facilities. The *prevalence* of deepfakes challenges the trustworthiness of visual and audio evidence, making it more difficult *to discern* between authentic and manipulated content.

The most practical blockchain solution to help ensure authentic digital content is (3)__, allowing creators to stake their reputation on the authenticity of their content by signing it with their public key. Protocols could rely on creators to stake an asset (USDC, ETH, etc.) that could be slashed if they sign inauthentic content. In the event that a protocol determines that some signed content is fake, the creator would lose their staked assets, leaving an immutable record of that public key's actions and reputation.

There are also solutions that could go well beyond a stand-alone public key signing mechanism. A more sophisticated solution could leverage real-world identities. By associating public keys with verified identities, a feedback and penalty system can be established to address misuse, such as signing *fraudulent* images or videos. With identities that are *soul-bound* and cannot be reissued on chain, it's impossible (4)___ once someone is deemed a malicious actor.

The effectiveness of this system relies heavily (5)___ on integrating public key signing with real-world identity verification. Blockchain identity systems such as Worldcoin and soul-bound tokens on Ethereum could play *a pivotal role* in establishing a decentralized and *tamper-proof* identity registry. This registry would correlate public keys with real-world identities, simplifying the trust-building process and holding individuals accountable for malicious actions.

One key to scaling this solution is embedding the signing capabilities into the products creators use, either in the software or hardware. For embedded hardware, the anticipation is that smartphones and other devices will soon integrate *inherent* hardware-based signing features for various media, including images and videos. In the software layer, we expect software providers like (6)____. This integration will empower creators to authenticate their work, while also acknowledging the specific tools utilized in the production process.

Another critical element of this system is a robust consensus mechanism that can distinguish between fake and real content and handle disputes and slashing. This would

require leveraging a network of nodes that are identifying the sources of watermarks and running deep fake detection algorithms. Invisible watermarks are likely the most *robust solution* as the sources of all content would be publicly accessible in the registry. An ideal solution would require people (7)__. While coordination is certainly a large undertaking, decentralized networks have proven the ability for large social coordination through strong economic *incentives*.

Reading

Read the interview with Kevin Werbach, a legal scholar at the University of Pennsylvania's Wharton School of Business, an expert on digital technologies, the writer of the book, "[The Blockchain and the New Architecture of Trust](#)" (MIT Press, 2018), who explains how, far from being a radical technology that makes government obsolete, the blockchain relies on the social cohesion, political stability and rule of law that governments often provide.). For questions 1-5, choose the answer from the list (A-H) to complete the conversation. There are two extra items that you do not need to use.

Q: There is so much hype over organisations using blockchain to "solve problems" where ordinary databases or non-blockchain systems would do, that it is hard to appreciate its real importance. In what sort of situations does blockchain technology best apply?

Kevin Werbach: (1)_____

Q: You argue in the book that blockchain doesn't remove the need for law or governance but changes where it happens. Explain.

Mr Werbach: (2)_____

Q: What is needed, in terms of regulation, to enable blockchain technology to become widely adopted in mainstream areas?

Mr Werbach: (3)_____

Q: Will bitcoin still exist in ten years?

Mr Werbach: (4)_____

Q: Your book mentions the crisis of trust in institutions. Can blockchain overcome these human-specific, cultural forms of lack of trust? Or will that "trust gap" between people and power persist, even as blockchain use expands?

Mr Werbach: (5)_____

A Regulation and innovation are not necessarily opposed. Regulators can foster adoption of new technologies by removing barriers to competition, highlighting public-policy objectives and promoting consumer trust. Investors lost billions of dollars last year in initial coin offering (ICO) scams and thefts. A “Wild West” environment advantages only the bad actors. Regulators can start by going after the easy cases through aggressive enforcement. Then they should identify where existing rules may unintentionally restrain activities, as with the application of Europe’s General Data Protection Regulation to immutable decentralised ledgers, or financial regulations assuming clearing and settlement processes that blockchain replaces.

B To be successful, blockchains must be trusted. They can produce immutable consensus over a transaction history. They can't guarantee you can trust who is transacting, what is transacted or who can change the rules. When someone exploited a hack to steal \$60m from a blockchain-based crowdfunding system, or when \$150m of cryptocurrency was locked irretrievably thanks to a programming bug, the blockchains themselves immutably executed the undesired transactions. Dealing with such inevitable problems is the domain of law, regulation and governance. These mechanisms must be called into play to help prevent conflicts, set boundaries and resolve disputes.

C Let's consider the example of a school where Blockchain is similar to a digital report card of a student. Say, each block contains a student record that has a label (stating the date and time) of when the record was entered. Neither the teacher nor the student will be able to modify the details of that block or the record of report cards. Also, the teacher owns a private key that allows him/her to make new records and the student owns a public key that allows him to view and access the report card at any time. So basically, the teacher owns the right to update the record while the student only has the right to view the record.

D A blockchain by itself can't redress structural power imbalances. It can even make them worse, by circumventing protective rules and intermediaries. And if you can't trust those putting data into a blockchain, it doesn't matter that no one can alter that data after the fact. In time, though, new institutions could arise that are built on blockchain trust. Some functions that required centralised power will shift to decentralised collaboration. As I stress in my book, blockchain is neither the end of, nor the solution to, trust. It's a new form of trust that must develop and be evaluated on its own terms.

E Blockchains are trust machines, as The Economist recognised in a [cover story](#) over three years ago. They're useful when trusted institutions and intermediaries are problematic, or to overcome a trust gap between transacting organizations. The issue isn't whether a centralised database could be employed in theory; it's whether one would be in practice. In contexts like supply-chain management, provenance and trade finance, companies lack a unified view of information because they don't fully trust their business partners. Blockchain enables what I call "translucent collaboration": sharing data without giving up control. Whether it's an improvement over the status quo, however, is highly context-specific.

F Blocks in the ledger are included in such a way as to build the longest chain, i.e., the chain with the greatest cumulative difficulty. Forking is a situation where there are two candidate blocks competing to form the longest blockchain and two miners discover a

solution to the proof-of-work problem within a short period of time from each other. The network is then divided, because some nodes get blocks from miner #1 and some from miner #2. A fork usually gets resolved in one block, because the probability that this situation happens again gets extremely lower with the next blocks that arise, so soon there is a new longest chain that will be considered as main.

Bitcoin is a cockroach. And I mean that as a compliment. It's shown itself to be incredibly resilient over the past decade, through technical problems, developer personality conflicts, business disputes, price bubbles and price collapses. Resilience might be bitcoin's signal achievement; it certainly hasn't become the widespread payment mechanism its early boosters envisioned. There will always be a community pursuing an uncensorable global digital currency, whether for illegal activity, creating "sound money," subverting authoritarian regimes or just making a quick buck. I expect bitcoin will represent a smaller share of cryptocurrency value in ten years, but it won't be zero.

Word study

Match the words in italics with their definitions:

1) block	a) a computer connected to the blockchain network that validates and relays transactions.
2) hash	b) a node that performs the process of validating transactions and adding them to the blockchain
3) node	c) a unit that measures the amount of computational effort required to execute operations, such as transactions and smart contracts, on the Ethereum network.

4) miner	d) a cryptographic function that takes an input and produces a fixed-size string of characters, which appears random. It is used to secure the data in a block.
5) ethereum (ETH):	e) any cryptocurrency other than Bitcoin. Examples include Ethereum, Litecoin, and Ripple.
6) altcoin	f) a digital record containing a list of transactions. Each block includes a timestamp transaction data, and a reference (hash) to the previous block.
7) gas	g) a decentralized platform that enables smart contracts and decentralized applications (dApps) to be built and run \ V out any downtime, fraud, or third-party interference.
8) fork	h) a type of cryptocurrency designed to have a stable value, often pegged to a fiat currency like the US Dollar.
9) deFi (Decentralized Finance)	j) a movement aiming to recreate traditional financial systems (like loans and exchanges) using decentralized blockchain technology.
10) stablecoin	k) a split in the blockchain where a single cryptocurrency diverges into two. This can be a "soft fork" (backward-compatible) or a "hard fork" (not backward-compatible).

Discussion point

Your Mathematics and Mechanics Faculty is trying to choose a new course for the coming year. The dean's office narrowed the list of suggestions down to two possibilities. You are part of the student committee that has been asked to recommend one of the courses. Course 1. Blockchain Technology. Course 2. Deepfakes and the New Disinformation War. Discuss these courses in small groups of three or four. Choose a person from your group for a brief summary of your discussion.

Information search Find as much information as possible about fight deepfakes if what is being done to fight deepfakes.

Over to you

1. Work in two teams. You are members of a conference committee. You are going to organize a conference on the topic "Why are deepfakes are a real problem". As a group make a list of research problems to be discussed within different workshops or an information bulletin containing a brief summary of all the workshop discussion points to attract prospective participants.

Web research task

Watch the films "Alternative Uses for Blockchain", "The Blockchain and Bitcoin", note down the most interesting facts mentioned in it and make a short presentation.

<https://www.youtube.com/watch?v=qcuc3rgwZAE&t=5s>

<https://www.youtube.com/watch?v=qBAOsB6ETrY&t=18s>

Unit 6

To Worry or not to Worry about AI?

A. Before you read

- Does rapid progress in AI worry you?
- Do you think we should develop non-human minds that might outnumber, outsmart and replace us?
- Can AI systems be considered moral agents capable of making ethical decisions?

Reading

Read the text.

The fear that machines will steal jobs is centuries old. But so far new technology has created new jobs to replace the ones it has destroyed. Machines tend to be able to perform some tasks, not others, increasing demand for people who can do the jobs machines cannot. Could this time be different? A sudden dislocation in job markets cannot be ruled out, even if so far there is no sign of one. Previous technology has tended to replace unskilled tasks, but LLMs can perform some white-collar tasks, such as summarising documents and writing code.

The degree of existential risk posed by AI has been hotly debated. Experts are divided. In a survey of AI researchers carried out in 2022, 48% thought there was at least a 10% chance that AI's impact would be "extremely bad (eg, human extinction)". But 25% said the risk was 0%; the median researcher put the risk at 5%. The nightmare is that an advanced AI causes harm on a massive scale, by making poisons or viruses, or persuading humans to commit terrorist acts. It need not have evil intent: researchers worry that future AIs may have goals that do not align with those of their human creators.

Such scenarios should not be dismissed. But all involve a huge amount of guesswork, and a leap from today's technology. And many imagine that future AIs will have

unfettered access to energy, money and computing power, which are real constraints today, and could be denied to a rogue AI in future. Moreover, experts tend to overstate the risks in their area, compared with other forecasters. (And Mr Musk, who is launching his own AI startup, has an interest in his rivals downing tools.) Imposing heavy regulation, or indeed a pause, today seems an over-reaction. A pause would also be unenforceable.

Regulation is needed, but for more mundane reasons than saving humanity. Existing AI systems raise real concerns about bias, privacy and intellectual-property rights. As the technology advances, other problems could become apparent. The key is to balance the promise of AI with an assessment of the risks, and to be ready to adapt.

So far governments are taking three different approaches. At one end of the spectrum is Britain, which has proposed a “light-touch” approach with no new rules or regulatory bodies, but applies existing regulations to AI systems. The aim is to boost investment and turn Britain into an “AI superpower”. America has taken a similar approach, though the Biden administration is now seeking public views on what a rulebook might look like.

The EU is taking a tougher line. Its proposed law categorises different uses of AI by the degree of risk, and requires increasingly stringent monitoring and disclosure as the degree of risk rises from, say, music-recommendation to self-driving cars. Some uses of AI are banned altogether, such as subliminal advertising and remote biometrics. Firms that break the rules will be fined. For some critics, these regulations are too stifling. (*The Economist*)

Mark the statements as True or False:

1. Regulation of AI is considered unnecessary by all experts as AI poses no real concerns today.
2. Machines tend to be able to perform some tasks, not others, increase demand for people who can do the jobs machines cannot.
3. Some researchers worry that future AIs may have goals that their human creators don't support.

4. The EU's proposed law categorizes different uses of AI by the degree of risk and requires increasingly stringent monitoring and disclosure as the degree of risk rises.

5. Existing AI systems raise real concerns about bias, privacy, and intellectual property rights.:

6. All AI researchers agree³) that the risk posed by AI is negligible and do not believe in the possibility of human extinction.

7. Experts believe that future AIs will have unrestricted access to energy, money, and computing power without any constraints.

Find a word in the text that means the same as the words and phrases below:

1. to exclude as a possibility (v) (para 1)
2. to give support (v) (para 2)
3. unlimited (adj) (para 3)
4. behaving in a way that causes damage (adj) (para 3)
5. impossible to enforce (adj) (para 3)
6. of this earthly world (adj) (para 4)
7. to encourage (v) (para 6)

B .Before you read

1. Can you name any legal standards for computer professionals?
2. What is the difference between legal and ethical standards?
3. Do you know what these documents are? Do you think they are important?

Computer Misuse Act

The Digital Millennium Copyright Act (DMCA)

General Data Protection Regulation (GDPR)

The Hacker's Manifesto

Digital Rights Management (DRM)

4. Which aspect of law or ethics do you think they may relate to?

Reading and Word study

Read the answers to the questions given above and match the highlighted words with the definitions (a-f):

1) <i>pursuit</i> (n)	a) to avoid cleverly or illegally
2) <i>malware</i> (n)	b) to officially force a rule etc.
3) <i>circumvent</i> (v)	c) computer software designed to damage the way a computer works
4) <i>impose</i> (v)	d) to break a law, promise etc.
5) <i>breach</i> (n)	e) an activity of a specified kind, especially a recreational
6) <i>purchase</i> (n)	f) to buy

5.

1. Computer Misuse Act

A piece of legislation *enacted* in the United Kingdom in 1990 to address computer crime and unauthorized access to computer systems. It is aimed to prevent hacking and unauthorized access to data. It criminalizes hacking, spreading *malware*, and other forms of cyber attacks.

2. The Digital Millennium Copyright Act (DMCA)

A United States copyright law that was signed into law in 1998. Its goal is to update copyright law for the digital age, specifically to address issues related to digital media and the internet. It includes provisions against *circumventing* management (DRM) and protects online service providers from liability for user content under certain conditions.

3. General Data Protection Regulation (GDPR)

A regulation in EU law on data protection and privacy for all individuals the European Union and the European Economic Area. It gives control to individuals over their personal data and to simplify the regulatory environment for international business by unifying the regulation within the EU. It *imposes* strict guidelines on data handling and includes provisions for user consent, data *breach* notifications, and the right to be forgotten.

4. The Hacker's Manifesto

A short essay written by a hacker known as The Mentor (Lloyd Blankenship) after his arrest in 1986. It expresses the hacker's mindset and philosophy. It is often considered a foundational text for hacker culture, advocating for the freedom of information and the *pursuit* of knowledge.

5. Digital Rights Management (DRM)

A set of access control technologies used by copyright holders to restrict the use of digital content and devices after sale. It prevents unauthorized redistribution of digital media and restricts the ways consumers can copy content they've *purchased*. DRM technologies are used to control how digital content is used, ensuring that it is not illegally copied or distributed.

Use of English

1. Read and think of the word which best fits each space. Use only one word in each space.

Computers play (1)___ increasingly important role in our society. One result of this is that decisions (2)___ by system designers have an impact (3)___ a growing number of people. Moreover, computer professionals need (4)___ balance their clients' demands with their obligations (5)___ society. In addition to ethical reasons (6)___ this, there (7)___ also practical reasons why this is necessary.

Firstly, negligence in the design or construction of IT systems can have profound economic or human consequences. For example, Hunt and Ferrario refer (8)___ a computer company (Fujitsu), where a faulty computer system design was responsible (9)___ widespread errors in the financial accounts of the UK's Post Office System. Many innocent people were accused (10)___ theft and wrongly imprisoned because the company (11)___ not acknowledge these errors. This resulted (12)___ damage to the lives of many people and their families. Furthermore, the reputation of the computer professionals (13)___ designed the system was (14)___ risk and some even (15)___ criminal investigations. For this reason, computer professionals need to ensure that their decisions are based (16)___ sound principles so they can be justified.

Secondly, the ethical values of a computer professional and their employer may be different. A Conflict of opinion can (17)___ between them on (18)___ their work is being put to beneficial or harmful uses. One example of this could be the construction, maintenance or operation of systems for surveillance or censorship. Another example could be the development of systems for warfare. These could be seen as beneficial (19)___ used for protection, but harmful if used for aggression (20)___ other countries. So, it is important that professionals understand the ethical values of companies before entering into employment contracts. *.(an excerpt from English for Computing 2023 Patrick Fitzgerald & Marie McCullagh)*

2.For questions 1- 8 , read the text below and use the word given in bold at the end of each line to form a word that fits in the space in the same line.

The light-touch approach is (1)___ to be enough. If AI is as **LIKE**
 important a technology as cars, planes and medicines—and
 there is good reason to believe that it is—then, like them,
 it will need new rules. Accordingly, the EU’s model is closest
 to the mark, though its classification system is (2)___ **WROUGHT**
 and a principles-based approach would be more flexible.

Compelling (3)___ about how systems are trained, **CLOSE**
 how they operate and how they are monitored, and requiring
 inspections, would be (4)___ to similar rules in other industries. **COMPARE**
 This could allow for tighter regulation over time, if needed.

A dedicated regulator may then seem (5)___; so too may **PROPER**
 intergovernmental treaties, similar to those that govern
 nuclear weapons, should plausible evidence emerge of (6)___ risk. **EXIST**
 To monitor that risk, governments could form a body modelled on Cern,
 a particle-physics laboratory, that could also study AI (7)___ and. **SAFE**

ethics—areas where companies lack incentives to invest as much as society might wish.

This powerful technology poses new risks, but also offers (8)___ ORDINARY opportunities. Balancing the two means treading carefully. A measured approach today can provide the foundations on which further rules can be added in future. But the time to start building those foundations is now

Over to you

Work in two teams. You are members of a conference committee. You are going to organize a conference on the topic “ How AI could change computing, culture and the course of history”. As a group make a list of research problems to be discussed within different workshops or an information bulletin containing a brief summary of all the workshop discussion points to attract prospective participants.

Web research task: Listen to Lecture “Cyberattacks: Phishing and Spear-phishing” delivered by Professor Martyn Thomas CBE,
<https://www.gresham.ac.uk/watch-now/cyberattacks-phishing-and-spear-phishing>
note down the most interesting facts about it and make a short presentation.

Discussion point

Your Mathematics and Mechanics Faculty is trying to choose a new course for the coming year. The dean’s office narrowed the list of suggestions down to two possibilities. You are part of the student committee that has been asked to recommend one of the courses. Course 1. *Phishing* . Course 2. *LLM*. Discuss these courses in small groups of three or four. Choose a person from your group for a brief summary of your discussion.

GLOSSARY

Altcoin: Any cryptocurrency other than Bitcoin. Examples include Ethereum, Litecoin, and Ripple.

Antecedent: The antecedent of a conditional is its first component clause (the if clause). In $P \rightarrow Q$, P is the antecedent and Q is the consequent.

Antisymmetric: A binary relation R is antisymmetric iff no two things ever bear R to one another, i.e., R satisfies the condition that $\forall x \forall y [(R(x, y) \wedge R(y, x)) \rightarrow x = y]$.

Argument: “Argument” is used in two different senses in logic.

1. Arguments as pieces of reasoning: an argument is a sequence of statements in which one (the conclusion) is supposed to follow from or be supported by the others (the premises).

2. Arguments in the mathematical sense: an argument is an individual symbol (variable or constant) taken by a predicate in an atomic wff. In the atomic wff $\text{LeftOf}(x, a)$, x and a are the arguments of the binary predicate LeftOf .

Aristotelian forms (A, E, I, O): The four main sentence forms treated in Aristotle’s logic: the A form (universal affirmative) All P ’s are Q ’s, the E form (universal negative) No P ’s are Q ’s, the I form (particular affirmative) Some P ’s are Q ’s, and the O form (particular negative) Some P ’s are not Q ’s.

Arity: The arity of a predicate indicates the number of individual constants (names) it takes to combine with the predicate to form a complete sentence. A predicate with an arity of one is called unary. A predicate with an arity of two is called binary. It’s possible for a predicate to have any arity, so we can talk about 6-ary or even 113-ary predicates.

Asymmetric: a binary relation R is asymmetric iff it is never reciprocated, i.e., R satisfies the condition that $\forall x \forall y (R(x, y) \rightarrow \neg R(y, x))$.

Backward induction: The procedure of solving an extensive-form game by first considering the last mover’s decision in order to deduce the decisions of all previous movers.

PBE (A perfect Bayesian equilibrium): is a set of strategies and beliefs such that the strategies are sequentially rational given the players’ beliefs and the players update beliefs via Bayes rule wherever possible.

Best response: A strategy of a player is a *best response* to the strategies of the others in the game if, taking the other players’ strategies as given, it gives her greater payoffs than any other strategy she has available.

Block: A digital record containing a list of transactions. Each block includes a timestamp transaction data, and a reference (hash) to the previous block.

Blockchain Explorer: A tool that allows users to view all transactions and activity on a blockchain network in real-time.

Braess' Paradox: States that, counterintuitively, adding a road to a road network could possibly impede its flow (e.g. the travel time of each driver); equivalently, closing roads could potentially improve travel times.

Commitment: The ability to choose and stick with an action that might later be costly.

Completeness: A formal system is complete if every valid inference is provable by means of the rules of the system.

Consensus Mechanism: A process used to achieve agreement on a single data value or a single state of the network among distributed processes or systems.

Dark Web: Part of the World Wide Web that is only accessible by means of social software, allowing users and website operators to remain anonymous

dApp (Decentralized Application): An application that runs on a decentralized network, often utilizing smart contracts on platforms like Ethereum.

Deductive vs. inductive: A deductive argument attempts to show that the conclusion is a logical consequence of the premises—that the conclusion must be true if the premises are true. An inductive argument does not attempt to show that the conclusion must be true, but only that its truth is made more probable by the truth of the premises.

Decentralization: The distribution of authority, information, and functions across a network of nodes, reducing the reliance on a central authority.

DeFi (Decentralized Finance): A movement aiming to recreate traditional financial systems (like loans and exchanges) using decentralized blockchain technology.

Dominant strategy: The best response to every possible strategy of the other player(s).

Dominant strategy equilibrium: A combination of strategies is a *dominant strategy equilibrium* if the relevant strategy for each player is a dominant strategy.

Ethereum (ETH): A decentralized platform that enables smart contracts and decentralized applications (dApps) to be built and run \ V out any downtime, fraud, or third-party interference.

Evolutionary Game Theory (EGT): A more specialized branch of game theory studies equilibria of games played by a population of players, where the fitness of the players derives from the success each player has in playing the game.

Evolutionary Stable Strategies (ESS): A strategy which if adopted by a population cannot be invaded by any competing alternative strategy. The concept is an equilibrium refinement to the Nash equilibrium.

Extensive-form game: A representation that specifies the order of play in a game.

First-mover advantage: A game has a *first-mover advantage* when the first player to act in a sequential game gets a benefit from doing so.

Fork: A split in the blockchain where a single cryptocurrency diverges into two. This can be a "soft fork" (backward-compatible) or a "hard fork" (not backward-compatible).

Game theory: The study of strategic interactions.

Game tree: An extensive-form representation of a game.

Gas: A unit that measures the amount of computational effort required to execute operations, such as transactions and smart contracts, on the Ethereum network.

Hash: A cryptographic function that takes an input and produces a fixed-size string of characters, which appears random. It is used to secure the data in a block.

ICO (Initial Coin Offering): A fundraising method where new cryptocurrencies or tokens are sold to investors, typically in exchange for other cryptocurrencies like Bitcoin or Ethereum.

Logical contradiction: A sentence that comes out false in every possible circumstance. Every logical contradiction is also a TW-contradiction, but not conversely. (See also TW-contradiction, FOcontradiction, TT-contradiction.)

Miner: A node that performs the process of validating transactions and adding them to the blockchain

Mixed strategy: A *mixed strategy* involves choosing different actions randomly.

Nash equilibrium: A strategy combination is a *Nash equilibrium* if each strategy is a best response to the strategies of others. A Nash equilibrium is a strategy in a game such that if all players adopt it, no player will benefit by switching to play any alternative strategy

Node: A computer connected to the blockchain network that validates and relays transactions.

Payoff matrix: Represents the payoffs for each action players can take.

Phishing: A form of social engineering and scam where attackers deceive people into revealing sensitive information or installing malware

Premise: A statement meant to support (lead us to accept) the conclusion of an argument

Private Key: A secret key that is used to sign transactions and provide access to the cryptocurrency held in a wallet. It should be kept secure and private.

Proof by contradiction (indirect proof): To prove $\neg S$ by contradiction, we assume S and prove a contradiction. In other words, we assume the negation of what we wish to prove and show that this assumption leads to a contradiction.

Proof of Work (PoW): A consensus mechanism where miners solve complex mathematical puzzles to validate transactions and create new blocks.

Proof of Stake (PoS): A consensus mechanism where validators are chosen based on the number of coins they hold and are willing to "stake" as collateral.

Proofs without premises : A proof without premises, as the name implies, contains no premises. Such a proof typically begins with a subproof assumption and ends when all subproofs have been closed. The conclusion of a proof without premises is called a theorem of the system of proof. In a sound system, every theorem is a logical consequence of the empty set of premises, i.e., is a logical truth.

Pure strategy: A *pure strategy* involves always choosing one particular action for a situation.

Simultaneous-move games: In *simultaneous-move games*, players pick their actions at the same time.

Smart Contract: Self-executing contracts with the terms directly written into code, running on a blockchain.

Soundness: “Sound” is used in two different senses in logic. 1. An argument is sound if it is both valid and all of its premises are true. 2. A formal system is sound if all the inferences that are permitted by the rules of the system are valid inferences, that is, if no invalid arguments are provable within the system.

Spear – phishing: A type of phishing attack that targets specific individuals or organizations typically through malicious emails.

Stablecoin: A type of cryptocurrency designed to have a stable value, often pegged to a fiat currency like the US Dollar.

Tautology: A sentence that is logically true in virtue of its truth-functional structure. This can be checked using truth tables since S is a tautology if and only if every row of the truth table for S assigns true to the main connective.

Token: A digital asset created on an existing blockchain, often representing assets, utilities, or rights within a specific project or ecosystem.

Value System: A set of personal principles formalized into a code of behavior.

Wallet: A digital tool (software or hardware) that stores private and public keys, enabling users to send and receive cryptocurrencies.

Zero-sum game: In a *zero-sum game*, one player’s loss is another’s gain, so the sum of the payoffs is zero

KEYS:

Unit1

Vocabulary 1g; 2e; 3d; 4b;5c;6a;7h;8f.

Word Formation 1.beautifully; 2 complexities; 3misled; 4 politicians;5 incredibly;6 assumptions; 7 impair; 8 repeatedly;9 infinite.

Unit2 Key terms: 1)d; 2)a; 3b)4)c;5)e **Reading1.** 1)to avoid logical pitfalls; 2) because of some underlying vagueness or ambiguity; 3) had neglected to ask what numbers were; 4) in any rigorous way; 5) reverse engineering of new concepts from; 6) of this axiomatic approach is; 7) that we all know how they behave.**Reading2.**1) in; 2)had; 3) been; 4) a; 5) round; 6) without; 7)put; 8)that; 9)on; 10) on; 11) in;12)rather;13) is;14) on;15) fact;16) by; 17) more; 18) by; 19) from; 20) played; 21) order;22) as;23) to; 24) who; 25) to; 26) set; 27) out; 28) once;29) either; 30) along **3.Word search** 1) flaw; 2) to mislead; 3) inadvertently; 4) to maintain; 5) to impose; 6) to advocate; 7) irrelevant;8) commitment; 9) contradiction; 10)to convince**6. Word Search1)**limbo; 2) unattainable;3) edifice; 4)to delve; 5) unorthodox;6) vindication;7) consistency;8) inherent.**5.Use of English1)** by; 2) who; 3) does; 4) then;5) is; 6) is; 7) himself;8) such; 9) terms; 10) of;11) to; 12) out;

Unit 3 Before you discuss: What is Game Theory? (the study of strategically interdependent behavior) What is strategic interdependence? (what I do affects your outcomes and what you do affects my outcomes, not just about winning and losing, though it could be.

https://www.youtube.com/watch?v=NSVmOC_5zrE&list=PLKI1h_nAkaQoDzI4xDIXzx6U2ergFmedo

Scan reading 1.Early ideas of game theory can be found in writings throughout history, including the Bible and works by René Descartes, Sun Tzu (author of The Art of War), and Charles Darwin.2.Game theory came of age around 1940 through the efforts of John von Neumann and Oskar Morgenstern at the Institute of Advanced Studies in Princeton.3.John von Neumann left Hungary when the Nazis invaded.4.The book Theory of Games and Economic Behavior was published in 1944. 1) c; 2) a; 3) b; 4) f; 5) i; 6) d; 7) e; 8) h; 9) g. **Reading and Use of English:** 1C;2D;3A;4E;5B.

Before listening1)to; 2) less; 3) more;4) prices; 5) out; 6) best; 7) too; 8) will; 9) away;10) being;11) are; 12) like; 13) to; 14) to. **Listening and Sentence Completion** 1) cooperation;2) to disarm; 3) to re-arm; 4) disarming; 5) disadvantage; 6) zero-sum; 7) football;8) auction 9)problem of renting and buying a house auction;

Unit 4. Reading1. 1) has made the greatest recent advances; 2) has often been aided; 3) have already processed photographs; 4) can make remarkably accurate recommendations about movies; 5) being used in many applications;6) fraudulent use of credit and debit cards; 7) are used for purposes that include the design of new pharmaceuticals; 8) is being used to predict where crime is likely to be committed; 9) supports the analysis of data from

the Large Hadron Collider at CERN and the search for interesting astronomical objects;
10) the neural network;

2. 1.yet;2) whose; 3) that; 4) of; 5) more;6) more; 7) more; 8) can; 9) to; 10) into; 11) addition;12) so; 13) to; 14) unable; 15) its; 16) extent. **Word Study**3. 1)to scale up; 2) to empower; 3) to enhance; 4) scalability; 5) compelling; 6) indispensable 7) to nurture

Use of English1.these milestones, its capabilities; 2. involves, make predictions; 3. on employment, fairness in; 4.to understand, generate=ing/; 5.include, on improving;6.related to, in certain domains;7. A significant role, may include; 8. Are tested and evaluated

Unit 5 Key terms:1)d; 2)c;3)a;4)b;5)f;6)e.**Reading and Use of English**1)to create realistic-looking videos of public figures saying or doing things they never did; 2) that falsely depicts them in compromising or inappropriate situations, leading to personal and professional consequences;3) to leverage public key cryptography;4) to avert the system and recreate another on-chain identity; 5) on integrating public key signing with real-world identity verification;6) PhotoShop and image generators like Stable Diffusion to incorporate public key cryptography mechanisms; 7)) to agree to a standard watermark solution **Reading** 1E; 2B; 3A;4G; 5D; **Word Study:** 1f; 2d; 3a; 4b; 5g; 6e; 7c; 8 k;9g; 10h.

Unit 6 Reading 1F; 2.T;3T;3T;4T;5T;6F; 7F; 1.to rule out; 2.to align with; 3. unfettered; 4.rogue; 5. unenforceable; 6. Mundane. **Word Study:** 1f; 2c; 3a;4b;5d; 6f. **Use of English** 1. 1)a; 2) made; 3) on; 4) to; 5) to;6) for; 7) are;8) to; 9) for; 10) of; 11) did; 12) in; 13) who;14) at; 15) faced; 16) on; 17) arise;18) whether; 19) when; 20) against;**2.** 1)likely; 2) overwrought; 3) disclosure;4) comparable; 5) appropriate;6) existential;7) safety; 8) extraordinary;

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