# ARTIFICIAL INTELLIGENCE



**Name:** .....

## 1 Complete the information about Alan Turing from Chapter One.

| | |
|---|---|
| **Name:** | Alan Turing |
| **Studied:** | at King's College,[1] ..... |
| **Job:** | [2] ..... |
| **Died:** | aged [3] ..... by [4] ..... |
| **Worked:** | for [5] ..... during [6] ..... |
| **Film about him:** | [7] ..... |
| **Invented:** | [8] ..... and the field of [9] ..... |

...../9

## 2 Put the events in the correct order (1–8).

**a** ☐ All the key ingredients of the modern computer were developed.

**b** ☐ David Hilbert asked if there are decision problems that cannot be answered by simply following a recipe of precise mathematical steps.

**c** ☐ ENIAC established the basic design for the modern computer, named the Von Neumann architecture.

**d** ☐ Scientists built the Manchester Baby in England.

**e** ☐ Scientists developed a machine called ENIAC to calculate information required for firing guns over long distances.

**f** ☐ The first computer in the world that you could buy was produced.

**g** ☐ Turing decided to try to answer the *Entscheidungsproblem*.

**h** ☐ Turing invented a mathematical problem-solving machine.

...../8

**3 Choose the correct answers (a, b, c or d) about Chapter Two.**

1 What were machines unable to do just after the Second World War?
- **a** complex mathematics accurately
- **b** complex mathematics quickly
- **c** things that people find difficult to do
- **d** use intelligence

2 Which of these are higher-level programming languages?
- **a** C
- **b** Turing
- **c** Eliza
- **d** Minecraft

3 How many instructions can a computer today follow every second?
- **a** tens of billions
- **b** 100 billion
- **c** 3,700 billion
- **d** 50,000 billion

4 Which of these problems is the easiest to write code for?
- **a** arranging lists of numbers
- **b** automated translation
- **c** mathematical calculations
- **d** playing board games

5 What do we call the goal of building programs that really do understand in the way that people understand?
- **a** logical AI
- **b** general AI
- **c** strong AI
- **d** weak AI

6 What do neural nets do?
- **a** Build systems for robots to operate in.
- **b** Create symbols for machines to follow.
- **c** Model how the human mind works in everyday tasks.
- **d** Model the different parts of the brain in intelligent systems.

...../6

**4 Complete the text. Choose from the sentences (a–g) below. There are two extra sentences.**

By the end of the 1950s, a new field of study had been established and the Golden Age of AI had begun. There were many AI systems built in this period, like SHRDLU, STRIPS and SHAKEY. [1] ..... The tools that we depend on now for developing programs were not available then, and even if they had been, could not have run on these computers. [2] ..... They also had to invent all sorts of clever programming tricks to make the programs work at all.

In the summer of 1956, the field of AI was given its name by a brilliant, young American academic called John McCarthy. [3] ..... One of the most famous things he developed was LISP, a programming language popular with AI researchers, which is still regularly taught and used across the world.

While working as a young professor at Dartmouth College in New Hampshire in 1955, McCarthy applied to the Rockefeller Institute for money to organize a summer school for international researchers with similar interests. [4] ..... As well as academics, people from the fields of industry, government, the military and other important groups attended the summer school. The USA typically developed computer technology by having people from different fields working together, which would establish it as the international leader in AI for years to come.

When applying for the Rockefeller money, McCarthy had to give a name to the summer school and he chose "artificial intelligence". [5] ..... Despite this, and an absence of any real progress in AI by the end of the summer school, a new academic field with McCarthy's chosen name was here to stay.

**a** The idea was that if these systems could be built, it would be possible to put them all together later.
**b** The Dartmouth summer school brought together most of the researchers who would be key to the future development of AI.
**c** Some people later regretted this choice of name as artificial also means fake, which can sound negative; and many of the tasks that AI researchers work on do not require any intelligence to do them.
**d** Four people who attended would go on to be among the most important researchers in AI.
**e** During the 1950s and 1960s, McCarthy developed a range of ideas in computing that we cannot imagine not knowing about today.
**f** Compared to modern computers, the machines used to build these systems were incredibly limited, slow and hard to use.
**g** AI researchers often had to work at night because these computers were used for more important work during the day.

...../5

**5 List the capabilities that seemed to be required for general-purpose AI, according to Chapter Three.**

**a** .....

**b** .....

**c** .....

**d** .....

**e** .....

...../5

**6** **Tick ✓ the five true sentences about SHAKEY from Chapter Four.**

**1** It moved objects such as boxes around an office environment. ☐
**2** It was not a real robot. ☐
**3** It had a television camera and range-finders. ☐
**4** It had technology to help it perceive things in its way. ☐
**5** It had no limits to the challenges it faced. ☐
**6** It needed the help of a specially painted and lit environment. ☐
**7** Its TV camera was only switched on when it was needed. ☐
**8** It could be used on any practical problem. ☐

...../5

**7** **Complete the rules for the Towers of Hanoi in Chapter Four.**

**1** Only one [1] ..... can be moved at a time between the [2] ..... ;
**2** At no time can any ring lie [3] ..... a [4] ..... ring.

...../4

**8** **Answer the questions about the John, Paul, George and Ringo combinational explosion problem in Chapter Five.**

**1** How many people do you need in a team for a particular project?

.....

**2** Why can't John and Paul work together?

.....

**3** What are the two possible solutions?

.....

**4** What is the further obstacle?

.....

**5** What are *n* and *m* in this problem?

.....

**6** When does this problem become more difficult?

.....

...../6

**9 Correct the sentences about the problems from Chapter Five.**

1 It seems difficult to see the answer to this problem, and it is a complex recipe to program on a computer.

.....

2 An old-fashioned computer might be able to evaluate 10 billion possible teams every second.

.....

3 That sounds a lot, until you realize that it would still need far, far more time to investigate all the alternatives than is available after the beginning of the universe!

.....

4 At present, we can improve computer technology enough to check all these possibilities in a crazy amount of time.

.....

5 So, although our basic approach of systematically searching through all the possible teams works in practice, it is not going to work in theory.

.....

6 An NP-complete problem is a problem for which it is hard to find solutions because there are not enough of them to check with an exhaustive search.

.....

...../6

**10 Circle the correct word to complete the text.**

One of the [1] **earliest / latest** expert systems in the 1970s was called MYCIN, developed at Stanford University to help doctors give expert advice about blood diseases in humans. MYCIN showed for the first time that AI systems [2] **could / couldn't** solve important problems better than human experts. Many later systems were based on it. The project was [3] **unsuccessful / successful** because real experts worked with the expert system; projects often failed when this was not the case. Over about five years MYCIN's knowledge was written in code and [4] **reduced / improved** until it contained hundreds of rules.

MYCIN was important because it had [5] **all / some of** the key qualities of expert systems. First, the system interacted as humans do with questions and answers, which has become the typical model for expert systems. And MYCIN's main job was [6] **treatment / diagnosis**, which has become the typical task for expert systems. Second, MYCIN could explain its reasoning, which became very important for applications of AI. If an AI system like MYCIN is working on a problem which can result in life or death, it is important that people are confident in what it advises them to do. Finally, MYCIN could deal with [7] **certainty / uncertainty**, which has since become a major topic of research in AI.

In MYCIN's case it was possible that the result of a user's blood test could be [8] **correct / incorrect**. To make good decisions, expert systems need to carefully consider lots of different evidence. To do this MYCIN used a technique called certainty factors, where a number is given to the level of belief in a particular piece of information. MYCIN performed its tasks as well as experts, [9] **and better / but worse** than family doctors.

...../9

## 11 Match the examples with the type of reasoning from Chapter Six.

**1**
- All humans are going to die.
- Emma is human.
- So, Emma is going to die.

**a** bad reasoning
**b** good reasoning
**c** good reasoning, but not necessarily true

**2**
- All professors are good-looking.
- Michael is a professor.
- So, Michael is good-looking.

**a** bad reasoning
**b** good reasoning
**c** good reasoning, but not necessarily true

**3**
- All students are hard-working.
- Sophie is a student.
- So, Sophie is rich.

**a** bad reasoning
**b** good reasoning
**c** good reasoning, but not necessarily true

...../3

## 12 Put the information from Chapter Seven in the correct column.

new-world view | logic, knowledge representation and reasoning | old-world view
Stanford University | the system is separated from the environment | MIT

| McCarthy | Brooks |
|---|---|
| | |
| | |
| | |

...../6

**13 Match the two parts of the sentences about the six behaviours that the vacuum-cleaning robot requires in Chapter Seven.**

**1** If I perceive an obstacle, .....
**2** If I am at the docking station and have a low battery, .....
**3** If I am at the docking station and am carrying dirt, .....
**4** If the battery is low or the dirt container is full, .....
**5** If I perceive dirt at the present position .....
**6** I choose a direction at random .....

**a** and I move in that direction.
**b** then I return to the docking station.
**c** then I change direction, choosing a new direction at random.
**d** then I empty the dirt container.
**e** then I shut down.
**f** then I switch on the vacuum.

...../6

**14 Complete the text with the missing words.**

Before long, it became clear that while behavioural AI had raised important questions about the beliefs on [1] ..... AI was based, it, too, had serious limitations. The problem was that the technology [2] ..... not be easily expanded. If all you want to do is to build a robot to vacuum an apartment, then behavioural AI is [3] ..... . A vacuum-cleaning robot does not have to reason, or talk in English, or solve complex problems. But it is hard to design behavioural systems with more than just a [4] ..... behaviours, because you cannot predict how they [5] ..... interact without trying them first, which takes time and money. As efficient as the solutions developed with a behavioural approach [6] ..... , they generally only solved very narrow problems, which could not easily be applied to others.

...../6

**15 Read these sentences about Chapter Eight. Write T (*true*) or F (*false*) or DS (*does not say*).**

**1** HOMER was developed in the early 1990s. .....
**2** It was a simulated robot which worked in the air. .....
**3** It could only collect one parcel at a time. .....
**4** Unlike SHRDLU it worked in a real environment. .....
**5** HOMER took instructions using about 800 words in English and in other languages. .....
**6** It could plan how to achieve and then perform its tasks, changing them as the situation required. .....

...../6

**16 Complete the text. Choose the correct words (a, b, c or d).**

From 2000 on, researchers began to wonder if software agents could talk to [1]

**a** all
**b** an
**c** each
**d** every

other.

The idea was not completely new, as back in the days of knowledge-based AI, researchers had developed languages that would allow expert systems [2]

**a** share
**b** shared
**c** sharing
**d** to share

knowledge. But this new idea, multi-agent systems, was different in one important way:

I want my agent to go out and do the best it can for me; you want your agent to go out and do the best it can for you; but my desires and preferences are [3]

**a** probably
**b** possible
**c** likely
**d** impossible

not the same as yours, and so neither will those of our agents be. Our agents are going to need the kind of social abilities that we all use in the everyday world to interact.

The new challenge for AI was to build agents that had these capabilities. It seems odd now that these social aspects of AI [4]

**a** have not been
**b** had not been
**c** have not being
**d** was not

considered sooner, but, before the development of multi-agent systems, researchers had been concentrating on developing individual agents, [5]

**a** for
**b** from
**c** with
**d** without

worrying about how they might interact with other AI agents. The possibility that there could be many agents, rather than just one, greatly changed the AI story. The problem an agent has to solve is that of knowing [6]

**a** how
**b** what
**c** when
**d** who

action to perform for a user. But if there are many agents around, whether

the action chosen by an agent is good or not will probably depend, at least in part, on what other agents choose to do. An agent should therefore consider what these other agents are likely to do when making its decision.

...../6

**17 Complete text. Choose the correct words. There are two extra words.**

| | | | | |
|---|---|---|---|---|
| | supervised learning | board games | text recognition | |
| input | trained | machine learning | output | data |

The goal of [1] ..... is programs that can calculate a desired output from data [2] ..... , without being given an explicit recipe for how to do this. A typical application for machine learning is [3] ..... : turning handwritten text into typed text. This is hard, as we all write in different and often unclear ways, and our pens lose ink on the paper, which makes it damaged and dirty. Text recognition is not like playing [4] ..... , where we have recipes that work in theory but need heuristics to make them practical. We just do not know what a recipe for text recognition might be. This is where machine learning comes in.

A machine learning program for text recognition would typically be [5] ..... by giving it many examples of handwritten numbers or letters, each with a label of the actual typed text. This kind of machine learning is called supervised learning and requires a lot of carefully chosen training [6] ..... to be successful.

...../6

**18 Write *Geoff Hinton*, *Fei Fei Li*, *Frank Rosenblatt*, *Walter Pitts* or *Warren McCulloch* in these sentences from Chapter Ten.**

1 ..... and ..... realized that neurons could be modelled as electrical circuits, or simple logical circuits in the 1940s.
2 This model was improved in the 1950s by ..... in the first neural net model to be actually used, called the perceptron model.
3 The ImageNet project was the idea of researcher ..... , working at the AI lab at Stanford from 2013 to 2018.
4 ..... and his team showed a system called AlexNet, a neural net that greatly improved image recognition in an international competition.

...../5

**19 Answer the questions about Chapter Eleven. Choose numbers from the box.**

| | | |
|---|---|---|
| £400,000,000 | fewer than twenty-five | twenty-nine |
| the early 1980s | forty-nine | 2014 |

1 When did Google buy DeepMind? .....
2 How much did it pay for the company? .....
3 How many people did DeepMind employ at the time? .....
4 How many Atari video games had DeepMind trained a program to play?
.....
5 When were the games from? .....
6 How many of the games did the program teach itself to play at above human-level?
.....

...../6

**20 For each question, choose the correct game from Chapter Eleven, A (*Breakout*), B (*Go*) or C (*Montezuma's Revenge*).**

Which of these games . . .

| | | | |
|---|---|---|---|
| 1 does not have an immediate reward? | A | B | C |
| 2 has an immediate reward? | A | B | C |
| 3 has much simpler rules than chess? | A | B | C |
| 4 required the use of two neural networks? | A | B | C |
| 5 saw a surprising result in the way the program learnt to play the game? | A | B | C |
| 6 saw the program performing badly? | A | B | C |

...../6

**21 Match the dates with the events. Draw lines between them.**

**In 2016:**

**In 2018:**

**At the end of 2018:**

**In April 2019:**

**a** DeepMind researchers presented AlphaFold, a system using machine learning techniques to predict future signs of Alzheimer's disease.
**b** researchers from tech company Nvidia showed fake pictures of people that looked totally real.
**c** scientists used AI to take the first-ever pictures of a black hole, an area of space with such powerful energy that nothing can escape it.
**d** the health insurance company Vitality started offering its customers Apple Watches, then changed their insurance costs.

...../4

**22 Match the words in the box with the definitions of driverless cars in Chapter Twelve.**

| | | |
|---|---|---|
| Conditional automation | High automation | No autonomy |
| Full automation | Partial automation | Driver assistance |

**Level 0:** ..... : The car has no automated controls. The driver is in complete control of the car at all times (although the car may warn the driver or give them other data). Most cars on the roads today are Level 0.

**Level 1:** ..... : The car takes some control from the driver, for example through an adaptive cruise control system, which can keep the car's speed the same, but the driver must pay complete attention.

**Level 2:** ..... : The car takes control of how fast and how it moves, although the driver is still expected to continually check the roads and be ready to intervene if necessary.

**Level 3:** ..... : The human driver is no longer expected to be continually checking the road, although the car may ask the user to take control if it finds a situation that it cannot manage.

**Level 4:** ..... : The car normally takes control, although the driver can still intervene.

**Level 5:** ..... : The dream of driverless cars: you get in a car, give your destination, and the car does everything.

...../6

**23 Complete these lists from Chapter Thirteen. Put the words from the box into the correct categories.**

| | | |
|---|---|---|
| share AI money | be safe | create intelligence for good purposes |
| protect itself | not injure or harm a human | obey human orders |

**The Asilomar principles:** .....

.....

.....

**The Three Laws of Robotics:** .....

.....

.....

...../6

**24 Complete the text. Form new words using the words in capital letters.**

Among the many different [1] ..... systems suggested, there seem to be three main [2] ..... according to Virginia Dignum at Umeå University in Sweden. The first is [3] ..... , which means that if an AI system makes a decision that affects someone, then that person has a right to an explanation of that decision. But as we have already seen, machine [4] ..... programs are not capable of explaining the reasons for their decisions at present.

The second is responsibility, or making it clear who is responsible for a decision – not the AI system, but the people or [5] ..... that created it. This introduces the issue of moral agency, the ability to identify right from wrong, and understand the effects of actions. It is easy to imagine that AI systems can be moral agents, but software is not [6] ..... for its actions. Responsibility in AI is not about building machines that are responsible, but about developing AI systems in a responsible way. A Siri-like software agent that made users think they were [7] ..... with a real person would be an [8] ..... use of AI by the developers; the software is not to blame, those who develop it are.

Thirdly, transparency means that we should be able to get to our data on an AI system, and understand any algorithms used within it.

ETHIC

SIMILAR

ACCOUNTABLE

LEARN

ORGANIZE

ANSWER

ACT

RESPONSIBLE

...../8

**25 Write NS (*not safe from AI*) or S (*safe from AI*) in the boxes next to these different types of jobs.**

| | | | |
|---|---|---|---|
| arts jobs | ☐ | ideas jobs | ☐ |
| jobs requiring dexterity | ☐ | jobs requiring perception | ☐ |
| factory jobs | ☐ | jobs that move people or things | ☐ |
| media jobs | ☐ | office jobs | ☐ |
| science jobs | ☐ | jobs that require social skills | ☐ |

...../10

**26 Circle the correct words.**

1 If the program is **bias / biased**, then it might not lend money to a certain group, or prefer to lend money to another group.
2 Machine learning can accidentally help to create biases, too, if the training data for a machine learning program is not **representation / representative**.
3 The glasses were linked to a smartphone, which could cover whatever the user was seeing with a **projected / projector** image.
4 But this does not answer the difficult question of how a particular group of atoms can lead to the **conscious / consciousness** experience of humans.
5 But the most useful way to predict and explain human behaviour is to suppose that a person's beliefs and desires will make them act **rational / rationally**.
6 Theory of Mind (ToM) is the practical ability that fully developed adults have which allows them **reasoning / to reason** about the beliefs and desires of others and themselves.

...../6

**27 Complete the sentences. Write the correct preposition and pronoun.**

1 The basic idea for this test was the Imitation Game, a Victorian game ..... someone tried to tell if another person was a man or a woman from their answers to questions.
2 The solution was modern machine learning techniques, ..... driverless cars would not be possible.
3 First-order logic provides a rich, mathematically precise language ..... such sentences can be shown.
4 The three control sub-systems were linked by another control sub-system, which listened ..... each one suggested and then decided which to follow.
5 McCarthy himself started an AI laboratory at Stanford University, in the heart ..... is now Silicon Valley.

...../5

**28 Complete the sentences with the correct reflexive pronouns.**

1 Turing ..... joined the team at Manchester University in 1948, and wrote some of the programs to run on it.
2 Firstly, the Blocks World is closed, so the only thing that causes change is SHRDLU ..... ; this would not be true in the real world.
3 So we could conclude that their power would get cheaper at the same speed, and the processors ..... smaller.
4 It is impossible to tell a program what we want if we do not actually know ..... .

...../4

**29 Match the words and write the new words or phrases.**

| | | | |
|---|---|---|---|
| **1** | algorithmic | tree | ..... |
| **2** | branching | problem | ..... |
| **3** | deep | bias | ..... |
| **4** | feature | learning | ..... |
| **5** | search | factor | ..... |
| **6** | undecidable | extraction | ..... |

...../6

**30 Match the words from exercise 29 with the definitions.**

**1** A computer program tries to find how to achieve a goal by starting from some initial state, using a limited range of actions and then creating this.

.....

**2** A mathematical problem that we know cannot be solved by a computer or a Turing machine.

.....

**3** Important machine learning techniques that use deeper, neural nets with more connections; bigger, carefully chosen training data groups; and some new techniques.

.....

**4** The problem of deciding which parts of a data group should be selected to train a program in machine learning.

.....

**5** The possibility that AI systems will not be fair when making decisions, because they are trained with biased data groups or because of badly designed software.

.....

**6** The number of choices you have to consider every time you make a decision. When playing a game, it is the number of ways you can move on average from a particular board position.

.....

...../6

Total...../180