Your notes

GCSE Computer Science: revision notes

Automated systems, robots and AI

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Start here: automated systems

- An **automated system** works by itself, using sensors, a microprocessor and actuators. The sensor measures, the microprocessor compares the reading with stored values and decides what to do, and the actuator acts.
- They are used in factories (production lines), transport (self-driving cars, automatic trains), agriculture (watering and feeding), weather stations, lighting, games and science experiments.
- Advantages: they work all day without breaks, are often faster and more accurate than people, and can work in dangerous places. Disadvantages: they are expensive to set up and maintain, can replace jobs, can fail if a sensor breaks, and can be hacked.

Robots

- A **robot** has a mechanical structure, electrical parts (sensors, microprocessors and actuators) and is programmable. Some move around; some, like factory arms, stay in one place.
- **Robots** work in factories (welding, painting), transport (warehouse **robots** and drones), agriculture (picking fruit), medicine (helping surgeons and delivering medicines), the home (vacuum cleaners and lawnmowers) and entertainment.
- They give consistent quality and can do dull, dirty or dangerous work, but they cost a lot, can't easily cope with anything new and can take people's jobs.

Artificial intelligence

- **Artificial intelligence** (AI) is a computer system that behaves as if it were intelligent: it can collect data and rules, reason about them, and in some cases learn and adapt.

- An **expert system** gives advice like a human expert, such as diagnosing a fault. It has a knowledge base of facts, a rule base of IF ... THEN rules, an **inference engine** that applies the rules to the user's answers, and an interface for asking questions and giving results.
- **Machine learning**: a program improves at a task by finding patterns in large amounts of data, without being given every rule, such as a spam filter that gets better as users mark emails.

Emerging trends (Edexcel IGCSE)

- Quantum computing uses qubits, which can be 0, 1 or both at once, so some problems, such as breaking codes, could be solved far faster.
- DNA computing uses molecules of DNA to store data and do calculations. It could store huge amounts of data in a tiny space.
- Nanotechnology works with materials a few billionths of a metre across, for example tiny sensors or faster, smaller processors.
- AI is spreading into translation, medical scans, chatbots and self-driving cars, which raises questions about jobs, bias and who is responsible for a mistake.

Common mistakes

- Saying a **robot** must look like a person. Most **robots** are arms, vehicles or machines.
- Confusing the knowledge base (facts) with the rule base (IF ... THEN rules) in an **expert system**.

Key terms

Automated system	A system that uses sensors, a microprocessor and actuators to work without people.
Robot	A programmable machine with a mechanical structure, sensors, a microprocessor and actuators.
Artificial intelligence	A computer system that behaves intelligently: it reasons and can learn.
Expert system	An AI that gives expert advice using a knowledge base, a rule base and an inference engine.
Machine learning	A program improving at a task by finding patterns in data.
Inference engine	The part of an expert system that applies the rules to the facts to reach a conclusion.

Quick questions

Cover the answers and test yourself: remembering is what makes it stick.

1. In an automated system, what does the microprocessor do?

Your notes

2. Which is an advantage of automated systems?
3. Which three things does a robot have?
4. Which is a typical use of robots in a factory?
5. Which part of an expert system holds the IF ... THEN rules?
6. Which part of an expert system applies the rules to reach a conclusion?
7. What is machine learning?
8. What can a qubit be that a normal bit can't? (Edexcel IGCSE)

Answers

1. Compares sensor readings with stored values and decides what to do
2. They can work all day without breaks
3. A mechanical structure, electrical parts and the ability to be programmed
4. Welding car bodies
5. The rule base
6. The inference engine
7. A program improving by finding patterns in data
8. 0 and 1 at the same time

What to do next

Practise 10 questions on this topic

Try 3 exam questions, with mark schemes

Read the lesson, one step at a time

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