



F9.3 Hardware, software and von Neumann

Logic and computer systems · GCSE · OCR J277 1.1.1, AQA 8525 3.4.1,
Edexcel 1CP2 3.1.1 · about 15 min

Name _____

Class _____

Date _____

What this lesson is about

Hardware and software, and the stored program concept in a tiny computer.

- Hardware and software
- The stored program concept
- Program and data in one memory
- Why it matters

Questions

5 marks in all

1. Which of these is software?

[1 mark]

- ☐ A The robot's firmware
- ☐ B The camera
- ☐ C The battery
- ☐ D The processor

2. What is the stored program concept?

[1 mark]

- ☐ A Program instructions and data are held together in the same memory
- ☐ B Programs are stored on a separate disk from data
- ☐ C Programs are wired into the processor
- ☐ D Every program is saved before it runs

3. Which is system software?

[1 mark]

- ☐ A An operating system
- ☐ B A web browser
- ☐ C A game
- ☐ D A word processor

4. What does this program print?

[1 mark]

```
memory = ["LOAD 3", "ADD 4", "HALT", 30, 12]
acc = memory[int(memory[0].split()[1])]
acc = acc + memory[int(memory[1].split()[1])]
print(acc)
```

5. How does the processor know which address holds the next instruction?

[1 mark]

- ☐ A The program counter holds its address
- ☐ B Instructions are marked differently from data
- ☐ C It reads every address in order until it finds one
- ☐ D The user types it in

The task: a stored program

Add a `SUB` instruction to the tiny computer, which subtracts the value at an address from the accumulator. Then put a program in memory that loads 50 from address 6, subtracts 8 from address 7, stores the answer at address 8 and outputs it, so the program prints `output: 42`. The robot should then drive forward the answer in centimetres, divided by 2, read from memory address 8.

```
# the two lines every program starts with: the commands, then the robot
from bugbot import *
connect()

memory = ["LOAD 6", "ADD 7", "STORE 8", "OUT 8", "HALT", "", 50, 8, 0]
```

Plan your program here, then type it in and press Run.



Do it on the robot

www.bugbotlab.com/learn/f9-3-hardware-software-and-von-neumann/

The simulator checks it and tells you when it passes. Nothing to install, no account.

Challenges

1. Add a `JUMP` instruction that sets the program counter to `a`, and use it to make a program that outputs forever. Then stop it.
2. What happens if the program counter reaches address 6? Try removing the `HALT`.
3. List five pieces of software BugBot uses, and say whether each is system or application software.