



A9.9 Input, output and storage

Computer architecture · A level · OCR H446 1.1.3, AQA 7517 4.7.4.1,
Eduqas A500QS 2.1 · about 25 min

Name _____

Class _____

Date _____

What this lesson is about

How barcode readers, cameras, laser printers and RFID work; magnetic, optical and flash storage; RAM, ROM and virtual storage.

- Input and output devices
- Secondary storage
- RAM and ROM
- Virtual storage
- Choosing a device

Questions

6 marks in all

- How does a passive RFID tag get the power to send its data? [1 mark]
 - ☐ A The reader's radio waves induce a current in the tag's antenna
 - ☐ B From a small battery in the tag
 - ☐ C From light falling on it
 - ☐ D It does not send data; the reader photographs it
- Which part of a laser printer melts the toner onto the paper? [1 mark]
 - ☐ A The fuser
 - ☐ B The drum
 - ☐ C The laser
 - ☐ D The toner cartridge
- What does the controller in an SSD do? [1 mark]
 - ☐ A Manages where data is stored in the NAND flash, including wear levelling and erasing blocks
 - ☐ B Spins the platters
 - ☐ C Moves the read/write head
 - ☐ D Converts light into data
- Why does a hard disk take longer to access data than an SSD? [1 mark]
 - ☐ A The head must move to the track and wait for the sector to rotate under it
 - ☐ B Hard disks store less data
 - ☐ C Magnetic data must be decompressed first
 - ☐ D Hard disks read data with a laser

5. What is virtual storage?

[1 mark]

- ☐ A Physical storage from several devices presented as if it were one storage device
- ☐ B Using part of the hard disk as extra RAM
- ☐ C Storage inside the processor
- ☐ D Read only memory

6. Which storage is best for a small robot that vibrates as it moves?

[1 mark]

- ☐ A Flash memory
- ☐ B A hard disk drive
- ☐ C A DVD
- ☐ D Magnetic tape

The task: how much flash does a camera need?

Use the robot's camera to work out storage needs. Take one frame with `camera_image(32, 24)`, which returns a list of rows, each row a list of pixels, and each pixel a tuple of three bytes (red, green, blue). - Count the pixels **from the image you took**, by measuring the lists, and print `pixels: 768`. - Work out how many bytes one frame needs, uncompressed, at 3 bytes a pixel, and print `bytes per frame: 2304`. - Work out how many whole frames fit in a 16 MiB flash chip (1 MiB is 1,048,576 bytes), and print `frames in 16 MiB: 7281`. - The camera itself sees 320 by 240 pixels. Print how many whole frames of that size fit in the same flash, as `full-size frames in 16 MiB: 72`. Do not type the answers in as numbers. The robot does not move.

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

image = camera_image(32, 24)
```

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



Do it on the robot

www.bugbotlab.com/learn/a9-9-input-output-and-storage/

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

Challenges

1. The robot must record 10 seconds of full-size, uncompressed frames into 16 MiB of flash. How many frames a second can it store? Give two changes that would let it store more.

2. Explain why a robot that shakes as it moves, like BugBot, should not use a hard disk.
3. A supermarket wants to know every item in a trolley without taking them out. Which input device would it use, and why?