



F9.5 CPU performance

Logic and computer systems · GCSE · OCR J277 1.1.2, AQA 8525 3.4.5 ·
about 15 min

Name _____

Class _____

Date _____

What this lesson is about

Clock speed, cores and cache, measured with models.

- Clock speed
- Cores
- Cache
- Putting it together

Questions

5 marks in all

- What does a clock speed of 3 GHz mean? [1 mark]
☐ A 3 billion clock pulses each second
☐ B 3 million instructions in total
☐ C 3 cores
☐ D 3 GB of cache
- Why might doubling the cores not halve the time a program takes? [1 mark]
☐ A Some of the work cannot be split across cores
☐ B Cores share one clock pulse
☐ C More cores use less cache
☐ D The operating system can only use one core
- Why does more cache usually make a CPU faster? [1 mark]
☐ A More data is kept in fast memory, so fewer slow trips to RAM are needed
☐ B Cache increases the clock speed
☐ C Cache adds more cores
☐ D Cache stores files when the power is off
- A job takes 60 seconds on 1 core and all of it can be split. How many seconds on 4 cores? [1 mark]

- What is a drawback of a higher clock speed? [1 mark]
☐ A The processor gets hotter and uses more power
☐ B It needs more RAM
☐ C It makes cache slower
☐ D It reduces the number of cores

The task: the cache model

Use `run_cache(requests, size)` on the request list `[5, 6, 5, 7, 5, 6, 8, 5, 6, 7]`, for cache sizes 1 to 6. Print one line for each size in the form `size <n>: <hits> hits`, then print `best size: <n>` for the smallest cache that gets the most hits, working it out with a loop.

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

def run_cache(requests, size):
    cache = []
    hits = 0
    for address in requests:
        if address in cache:
            hits = hits + 1
            cache.remove(address)
        elif len(cache) == size:
            cache.pop(0)
        cache.append(address)
    return hits, len(requests) - hits

requests = [5, 6, 5, 7, 5, 6, 8, 5, 6, 7]
```

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



Do it on the robot

www.bugbotlab.com/learn/f9-5-cpu-performance/

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

Challenges

1. With 80% of a job splittable, how many cores does it take to get under 20 seconds for a 60-second job?
2. Make a request list where a cache of 2 gets no hits at all.
3. Why does a phone slow its processor down when it gets hot?