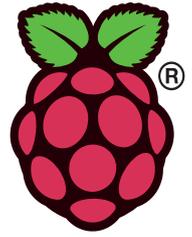


CLASSROOM CHALLENGE



HOW HARDWARE CHARACTERISTICS CAN AFFECT THE PERFORMANCE OF A COMPUTER

In this lesson you will investigate and document how some of the key properties of memory, secondary storage and the CPU relate to the performance of a computer.

TASK 1 – INTRODUCTION (10 minutes)

What do you think makes a good computer?

Write your answer here.

A computer that is designed to work well in one situation will not necessarily work well in others. Provide examples to define what represents a well-performing computer.

Write your answer here.

Your teacher is going to discuss a few ideas with you to try and determine what affects whether a computer is “working well”. When the class reaches a decision write it below in your own words.

Write your answer here.

TASK 2 – RESEARCH (30 minutes)

CPU SPEED

You will recall from previous lessons that the CPU is responsible for executing instructions that form computer programs.

You may have noticed that when computers are advertised on television and in media publications they state the CPU speed (sometimes known as frequency) and that this value is not always the same as the CPU speed advertised for a different device. For example the frequency of my computer's CPU is 3.40GHz whereas the frequency of my mobile phone's CPU is 528MHz.

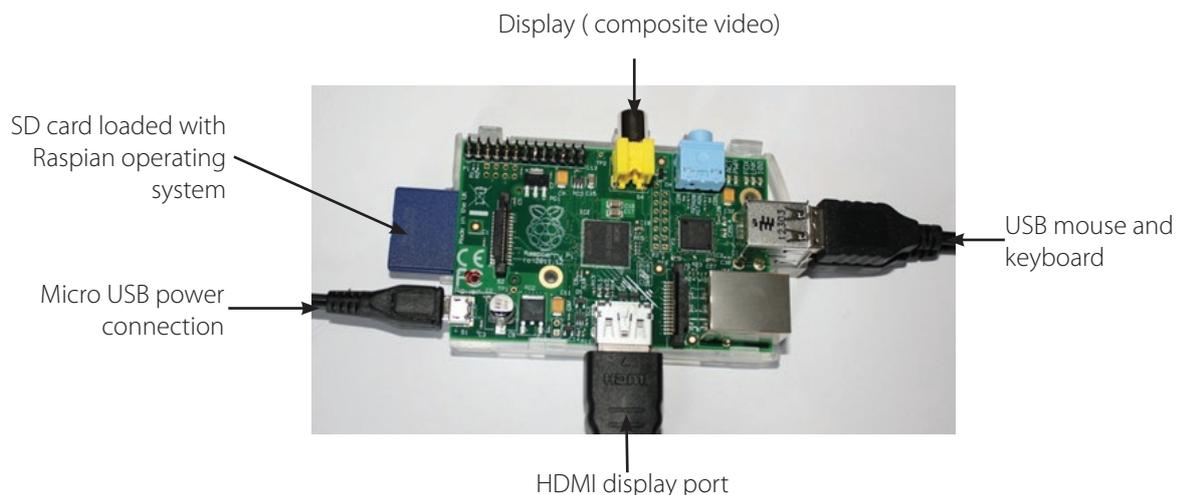
What do you think are the benefits of having a faster CPU? Are there any disadvantages?

Write your answer with explanation here.

You are going to configure your Raspberry Pi to run at various speed settings and record how long it takes to start up. This will enable us to determine whether the changes we make impact the performance of the Raspberry Pi.

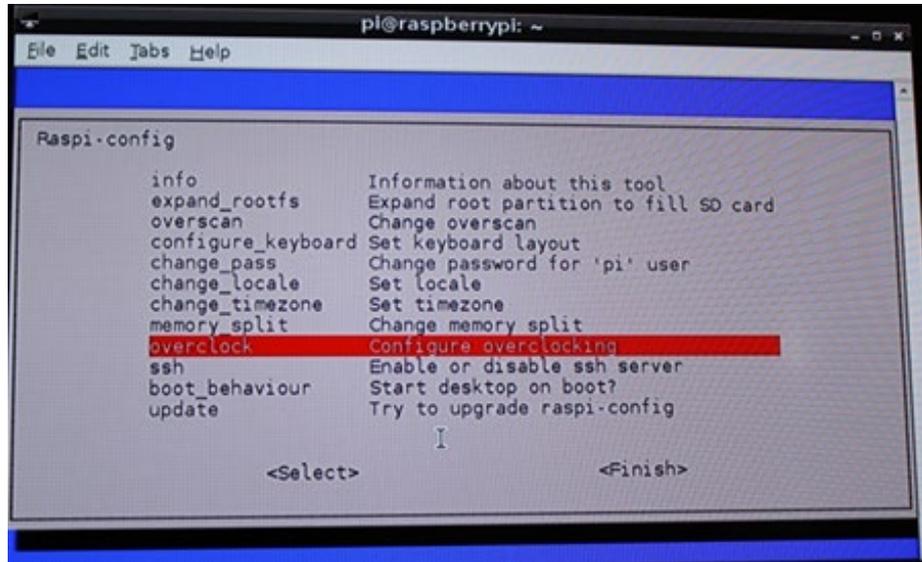
To change the speed setting of your Raspberry Pi you need to:

1. Connect the Raspberry Pi as shown below:



2. Start the Raspberry Pi and wait for it to boot up.
3. When the command prompt appears type:
sudo raspi-config
Press enter on the keyboard.
4. A screen labelled "Raspi-config" will open and show a menu containing several options.

5. One menu option is labelled **overclock**. Press the down arrow on the keyboard until this option is highlighted and press enter.



6. You may get an advisory message saying overclocking may reduce the lifetime of your Raspberry Pi. Press OK.



- You will be presented a screen titled “Choose overclock preset” that contains 5 options – None 700MHz; Modest 800MHz; Medium 900MHz; High 950MHz; and Turbo 1000MHz. Choose the top option (None 700MHz) and press enter.



- You will be taken back to the “Raspi-config” screen.
- Get ready to start your stop-watch.
- Select finish from the “Raspi-config” screen and start your stop-watch.
- The Raspberry Pi will reboot itself. You should stop your stop-watch when it has rebooted.
- Write the time taken to boot up in the “None 700MHz” row of the table below.

Repeat steps 3–12 above but select a different CPU setting each time. Again record the results in the table.

CPU Setting	Time taken
None 700MHz	
Modest 800MHz	
Medium 900MHz	
High 950MHz	
Turbo 1000MHz	

Can you spot a pattern in the results? Describe that pattern in the box below.

Write your answer here.

TASK 2 – RESEARCH (continued)

SECONDARY MEMORY CAPACITY AND SPEED

You will recall from previous lessons that secondary memory is used for storing computer programs and data. For example when you create a presentation and save it, it will be stored in your computer's secondary memory.

There are a number of different types of secondary memory including hard-drives, SD Cards, USB sticks and Re-writable DVDs. When you first set up the Raspberry Pi you will have noticed it uses an SD card for its secondary memory –digital cameras also use SD cards.

Why do you think the inventors of the Raspberry Pi chose to use SD cards for secondary memory?

Write your answer here.

SD Cards have two main characteristics – a capacity (how much information they can store) and a speed which is sometimes called their class. The picture below shows an SD card that shows these properties on the outside.



This is the Class of the SD Card

This is the Capacity of the SD Card

You can use the following table to work out the speed of SD Card from its class

Class	Speed
Class 2	2 MB/Sec
Class 4	4 MB/sec
Class 6	6 MB/sec
Class 10	10 MB/sec

Some older memory cards state their speed as a multiplication sign with a number next to it. For example you might see cards labelled as "100x" or "16x". The problem with this is that different manufacturers used it to mean different things which made it impossible to compare different types of cards with each other.

Your teacher has provided you with a variety of SD Cards containing the Raspbian Wheezy system image. Your task is to record how long the Raspberry Pi takes to boot with each of these cards.

Record your results in the following table.

Memory Card Capacity	Memory Card Class/Speed	Time Taken

Look at the result for memory cards with the same class/speed. What difference does having different capacity memory cards make to the time taken?

Write your answer here.

Look at the result for memory cards with the same capacity. What difference does having different class/speed memory cards make to the time taken?

Write your answer here.

TASK 2 – RESEARCH (continued)

MEMORY ALLOCATION

You may recall from previous lessons that RAM (random access memory) is where the computer stores the programs and data it is currently working with. The CPU is able to access information in RAM very quickly which means that it can complete tasks more quickly if the information it needs is available in RAM.

Computers often have a second type of specialised memory call video RAM. This memory is dedicated to providing graphics and normally has two roles; the first is enabling the screen you are looking at to be shown; the second is providing quickly accessible storage to graphics such as textures you might find in games.

Some computers have separate RAM and video RAM whilst others combine the two and call it shared RAM. The Raspberry Pi has 256MB or 512MB (depending on the model) of shared RAM. It uses some for creating and displaying graphics and the rest for storing data and programs which are currently in use.

What sort of programs do you think would require more video RAM to be available to them? What would happen if that RAM was not available?

Write your answer here.

The Raspberry Pi allows us to change how the memory is allocated between normal RAM and video RAM. Your task is to experiment with these allocations and to record the effect that changing them has.

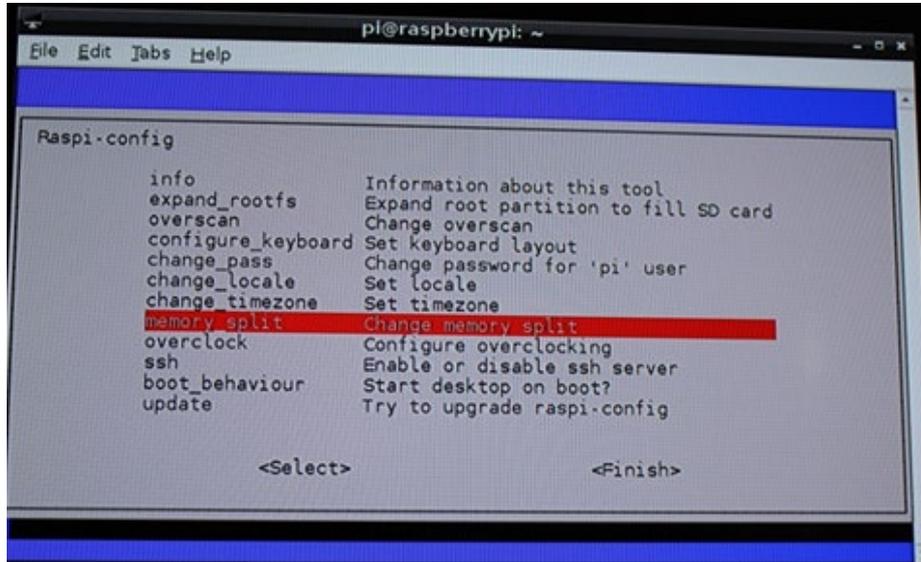
To change the RAM settings on your Raspberry Pi you need to

1. Connect the Raspberry Pi.
2. Start the Raspberry Pi and wait for it to boot up.
3. When the command prompt appears type:

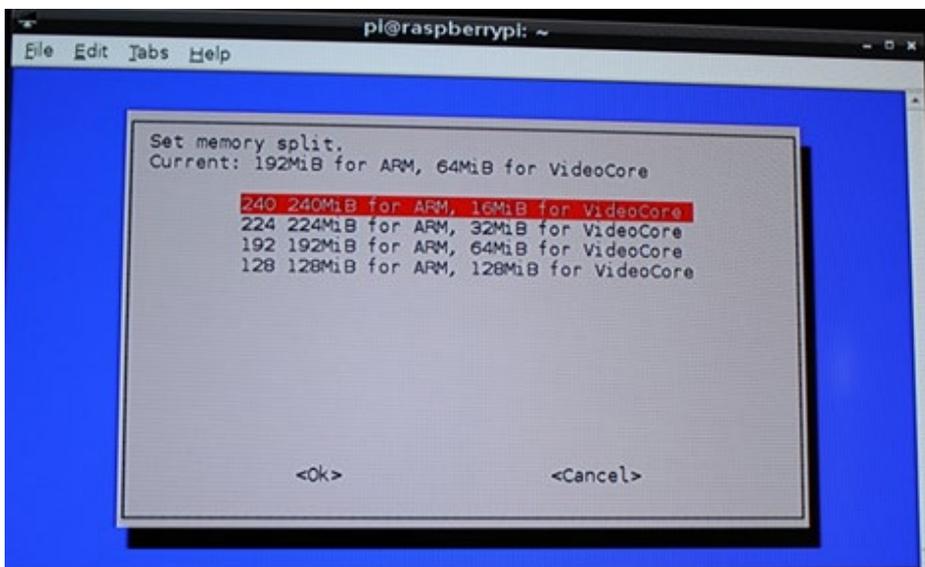
sudo raspi-config

Press enter on the keyboard.

4. A screen labelled “Raspi-config” will open and show a menu containing several options.
5. One menu option is labelled **memory_split**. Press the down arrow on the keyboard until this option is highlighted and press enter.



6. You will be presented a screen titled “Set Memory Split” that contains a number of options. These options depend on which model of the Raspberry Pi you have.
7. Choose one of the options and note the settings in the table below.



8. Select OK.
9. You will be taken back to the “Raspi-config” screen.
10. Get ready to start your stop-watch.
11. Select finish from the “Raspi-config” screen and start your stop-watch.
12. The Raspberry Pi will reboot itself. You should stop your stop-watch when it has rebooted.
13. Write the time taken to boot up in the table below.

Repeat steps 3–13 above but choose a different memory setting each time.

Memory for ARM (RAM)	Memory for VideoCore (Video Ram)	Time Taken

Can you spot a pattern in the results? Describe that pattern in the box below.

Write your answer here.

Which configuration worked best for you?

Write your answer here.

Why do you think this was?

Write your answer here.

TASK 3 – REVIEW (30 minutes)

You have investigated how various hardware characteristics affect the performance of the Raspberry Pi. In doing this you have undertaken a significant amount of primary research. It is now time to summarize your findings.

List 5 different methods of communication to explain what you have discovered to someone who is not an IT expert. Give one advantage and one disadvantage for each method.

Method	Advantage	Disadvantage

What are the 3 most important things that you would want to include in this?

Write your answer here.

Choose one of the methods you listed above and use this to create a record of your work. Some approaches, such as creating a YouTube video, might require you to use special resources so you should check with your teacher before starting.