# 2.1 Algorithms – L1 Activity 2

## Performance of a processor

Following are challenges/questions related to Performance of a Processor. They are colour coded by difficulty where:

Green – Easy challenges (Levels 1-5)

Blue – Harder challenges (Levels 5-9)

Purple – Extension Activity

For the following scenarios state the exact effect on performance of the change suggested:

If you started with a 1GHz Single Core Processor and improved to a 2GHz Single Core

1GHz

2GHz

1 Billion Instructions per second 2 Billion Instructions per second

How many more instructions are processed per second?

Half as many Halved

Four times as many Quadrupled

Twice as many Doubled

If you started with a 1GHz Single Core Processor and improved to a 4GHz Single Core

1GHz

4GHz

1 Billion Instructions per second 4 Billion Instructions per second

How many more instructions are processed per second?

Half as many Halved

Four times as many Quadrupled

Twice as many Doubled

If you started with a 2GHz Single Core Processor and improved to a 4GHz Single Core

2GHz

4GHz

2 Billion Instructions per second 4 Billion Instructions per second

How many more instructions are processed per second?

If you started with a 2GHz Single Core Processor and improved to a 8GHz Single Core

2GHz

8GHz

2 Billion Instructions per second 8 Billion Instructions per second

How many more instructions are processed per second?

## Reminder

By doubling the number of cores, you also double the number of instructions executed per second.

Two cores both operating at 1GHz (1 Billion Instructions per second) means that in effect 2 Billion Instructions are executed every second. If two cores are operating at 2GHz (2 Billion Instructions per second each) – this means that overall the processor would be executing 4 Billion Instructions per second.

2GHz

1GHz

1GHz

2GHz

2 Billion Instructions 4 Billion Instructions

The effect of going from a Dual Core 1GHz to a Dual Core 2GHZ is that the performance doubles.

**For the following scenarios state the exact effect on performance of the change suggested:**

2 GHz Clock Speed of a Single Core Processor is improved to a 2GHz Dual Core Processor

2GHz

2GHz

2GHz

Billion Instructions 4 Billion Instructions

**Effect:**

2 GHz Clock Speed of a Single Core Processor is improved to a 2GHz Quad Core Processor

2GHz

2GHz

2GHz

2GHz

2GHz

2 Billion Instructions 8 Billion Instructions

**Effect:**

1 GHz Clock Speed of a Single Core Processor is improved to a 2GHz Dual Core Processor

Effect:

1 GHz Clock Speed of a Dual Core Processor is improved to a 4GHz Dual Core Processor

**Effect:**

1. GHz Clock Speed of a Single Core Processor is improved to a 4GHz Quad Core Processor

**Effect:**

4 GHz Clock Speed of a Single Core Processor is improved to a 4GHz Eight Core Processor

**Effect:**

For the following match a Processor on the left with a Processor on the right where the number of instructions executed per second are equal.

|  |  |  |
| --- | --- | --- |
| 01 GHZ  Dual Core |  | 2GHZ  Quad Core |
| 2 GHZ  Dual Core |  | 4 GHZ  Quad Core |
| 4 GHZ  Dual Core |  | 1 GHZ  Single Core |
| 2 GHZ  8 Core |  | 2 GHZ  Single Core |
| 500MHz  Dual Core |  | 1 GHZ  Quad Core |

For the following, match a Processor on the left with a Processor on the right where the number of instructions executed per second are equal.

|  |  |  |
| --- | --- | --- |
| 2 GHZ  Dual Core |  | 2GHZ  Single Core |
| 1 GHZ  Dual Core |  | 2 GHZ  Quad Core |
| 4 GHZ  Dual Core |  | 16 GHZ  Single Core |
| 2 GHZ  8 Core |  | 4 GHvZ  Single Core |
| 500MHz  Dual Core |  | 1 GHZ  Single Core |

**Extension Task**

Find out the clock speed and the number of cores of the computer that you use either at school or at home.

Suggest the overall performance improvements based on improving your processor.

## Answers:

1. Doubled (Twice as many)

As the number of instructions has increased from 1Billion to 2Billion – this is twice as many.

1. Quadrupled (Four times as many)

As the number of instructions has increased from 1 Billion to Billion – this is four times as many.

1. Doubled

To go from 2 Billion to 4 Billion is doubling

1. Quadrupled

2 Billion to 8 Billion is four times as many

1. Doubled

The clock speed has stayed the same but there are twice as many cores meaning that the instructions have gone from 2 Billion to 4 Billion (Doubled).

1. Quadrupled
2. Quadrupled

The number of cores has doubled from one to two, and also the number of instructions executed per core has doubled. Therefore the overall effect is quadrupled. (1 Billion up to 4 Billion)

1. Quadrupled
2. 8 times as many

2GHz Single core = 2 Billion instructions

4GHz Quad Core = 4 Billion per core which means 16 Billion in total

1. 2 Billion to 16 Billion is 8 times as many

8 times as many

4GHz per core (single core) = 4 Billion Instructions

4GHz per core (Eight core) = 32 Billion Instructions

4 Billion to 32 Billion is 8 times as many

|  |  |  |
| --- | --- | --- |
| 1 GHZ  Dual Core |  | 2GHZ  Quad Core |
| 2 GHZ  Dual Core |  | 4 GHZ  Quad Core |
| 4 GHZ  Dual Core |  | 1 GHZ  Single Core |
| 2 GHZ  8 Core |  | 2 GHZ  Single Core |
| 500MHz  Dual Core |  | 1 GHZ  Quad Core |

|  |  |  |
| --- | --- | --- |
| 2 GHZ  Dual Core |  | 2GHZ  Single Core |
| 1 GHZ  Dual Core |  | 2 GHZ  Quad Core |
| 4 GHZ  Dual Core |  | 16 GHZ  Single Core |
| 2 GHZ  8 Core |  | 4 GHZ  Single Core |
| 500MHz  Dual Core |  | 1 GHZ  Single Core |

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