# Homework 3 Types of processor

1. a) A low-cost von Neumann machine has an address bus of 16 bits. In this computer, a unit of addressable memory is two bytes. How many KiB of addressable memory can be used? [1]

2 bytes = 2/1000 kilobytes = 0.0019 kibibytes

b) (i) Explain the basic difference between von Neumann architecture and Harvard architecture. [2]

Harvard architecture stores data and instructions separately, they don’t compete for the same buses when being retrieved and fetched between CPU and memory. In Neumann’s, data and instructions are stored in same memory.

(ii) Why is Harvard architecture potentially able to achieve higher processing speeds than von Neumann architecture? [1]

The data and instructions are stored separately so they use separate buses to go between the CPU and memory. Since they don’t have to compete for the same bus, both instructions and data could go to the CPU at the same time to be processed instead of one at a time.

(iii) Give a typical use of each type of architecture. [2]

Harvard may be used in large programs that require super fast processing while having large memory. Like digital signal processing.

Neumann is used in more conventional and generic computers that don’t need to be super fast and have a decent memory size. Like a PC, laptops, servers.

2. Compare the features of a Reduced Instruction Set Computer (RISC) architecture with that of Complex Instruction Set Computer (CISC) architecture, stating **one** advantage of each. [6]

In a RISC architecture, it is composed of many simple instructions that can be put together to make more complex commands. All the base instructions take only one clock cycle which means when they are used together, pipelining is possible. In a CISC however, there are more built in commands instructions. This allows the CPU to process and carry out more complex instructions with fewer instructions since some complex instructions are already built in. For example in a RISC, you may have to use multiple lines of basic instructions to create an instruction that multiplies numbers, whereas in a CISC there might already be an instruction that specifically multiplies numbers. RISC has to use more instructions to do an action, whereas CISC can use fewer. An advantage of RISC is it’s ability to pipeline meaning it can run complex just as fast as a CISC instruction since combining pipelining and the one clock cycle time to run an instruction allows good efficiency. CISC however can reduce the amount of RAM needed to do an action since fewer lines of code are needed to get the same action done since CISC is made up of more complex instructions, so you don’t have to make from the ground up the instruction of the same action.

3. Describe briefly the features of a Graphics Processing Unit (GPU), stating why it is particularly suitable for image processing. [3]

A GPU is a specialised electronic circuit that is efficient at manipulating computer graphics and image processing. GPUs have thousands of smaller, more efficient cores that are designed to do multiple tasks simultaneously. It utilises parallel processing to the maximum to efficiently process graphics and images. These thousands of cores allow for easy image processing.

Total 15 marks