University of London International Programmes

CO1110 – Introduction to computing and the Internet

Coursework assignment 1

2015–2016

This coursework assignment consists of three questions. Full marks will be awarded for complete answers to all three questions. The marks for each part of a question are indicated at the end of the part in [.] brackets.

There are 100 marks available for this assignment.

Your coursework assignment should be submitted as a single PDF file, using the following file-naming conventions:

FamilyName_SRN_COxxxxcw#.pdf (e.g. Zuckerberg_920000000_CO3323cw2.pdf)
- o *FamilyName is your family name (also known as last name or surname) as it appears in your student record (check your student portal)*
- o *SRN is your Student Reference Number, for example 920000000*
- o *COXXXX is the course number, for example CO1108, and*
- o *cw# is either cw1 (coursework 1) or cw2 (coursework 2).*

Question 1

(a) An Operating System consists of basically two main components: the kernel and its libraries. The kernel manages hardware resources and it has a set of managers to manage these basic resources. Name the three managers and briefly describe each one.

(b) How many bits would we need to represent:

   i. The 256 colours supported by the VGA Mode 13h standard.

   ii. The 3,120,000 processing cores of the largest supercomputer in the Top 500 list of supercomputers in June 2015 (http://www.top500.org/lists/2015/06/).

(c) Explain the three different types of mapping procedures, direct mapping, associative mapping and Set Associative mapping, in the organisation of cache memory. Illustrate your answer with a diagram showing how each of these three mapping procedures works.

(d) A computer memory unit has 256 k words. Each word has 32 bits. A binary instruction has four parts: an indirect bit, an operation code, a register code part to specify one of the 64 registers and an address part. An instruction binary code is stored in word memory.

   i. How many bits are needed for the operation code, the register code and the address part?

   ii. Draw the instruction word format indicating the number of bits of each part.

[40]

Question 2

(a) Assume we use a pipeline with a 5 stage instruction: IF, ID, EX, MEM and WR. Consider the following sequence of instructions:

Load R4, 100(R2)

Add R5, R2, R3

Sub R6, R4, R5

And R7, R2, R5

   i. Identify all the data dependencies in the above instruction sequence. For each dependency, indicate the two instructions and the register that causes the dependency.

   ii. Assume that the pipeline does not use operand forwarding and that the only sources of pipeline stalls are the data hazards. Draw a multi-cycle pipeline

diagram to show the execution of the above four instructions. How long does it take for the instruction sequence to complete?

    iii. We now assume that the pipeline uses operand forwarding. Draw a diagram that represents the flow of instructions through the pipeline during each clock cycle. Indicate operand forwarding by arrows. How long does it take for the instruction sequence to complete in this case?

[30]

Question 3

(a) Given the following bit pattern:

$$0010\ 0100\ 1001\ 0010\ 0100\ 1001\ 0010\ 0100$$

  i. What decimal number does it represent, assuming it is a two's complement integer?

  ii. What decimal number does it represent, assuming it is a single-precision floating point number?

(b) Explain how addition and subtraction of floating point operations are carried out. Give an example showing how each step is carried out.

(c) Let X and Y be the following single precision floating-point numbers:

$$X = 11000110110110000000000000000000$$

$$Y = 00111111011100000000000000000000$$

Perform the following operations:

  i. X+Y

  ii. X*Y

   Show all your work.

[30]

[TOTAL 100]

[END OF COURSEWORK ASSIGNMENT 1]