

CS-113
FROM LANGUAGES TO HARDWARE
Attempt 2 questions out of 3

Question 1

(a) Draw truth tables showing the logical operation of each of the following:

- (i) An Exclusive OR gate;
- (ii) a NAND gate;
- (iii) a level triggered D-type latch.

[3 marks]

(b) Clearly explain the operation a Master Slave D-type bistable. Your account should include an appropriate circuit diagram.

[8 marks]

(c) Within the context of a multi-tasking operating system, explain the nature and function of a Process.

[8 marks]

(d) Simplify the following Boolean expression algebraically. You should clearly state any Boolean propositions or theorems used:

$$\bar{Y}.\bar{X}+Y.\bar{X}$$

[6 marks]

Question 2

- (a) Distinguish between sequential and combinatorial logic. In each case you should illustrate your answer by providing an example circuit accompanied by a brief description of the circuit's operation.

[5 marks]

- (b) Suppose that a processor is handling an interrupt when a second interrupt occurs. Describe in detail the events that will take place in this situation.

[5 marks]

- (c) Describe in detail three types of pipeline hazard. In each case explain how the impact of the hazard may be reduced.

[9 marks]

- (d) Most computers make use of a hierarchy of memory types. Explain clearly and in detail why computers use such a memory structure rather than one single form of memory. Your account should include an explanation of the concepts of spatial and temporal locality.

[6 marks]

Question 3

(a) Undertake the following calculations:

- (i) Convert the hexadecimal number CD to binary;
- (ii) convert the decimal number 93 to hexadecimal;
- (iii) perform the following binary addition: $1011 + 1100$

[6 marks]

(b) Explain the function of the Program Counter within a microprocessor.

[4 marks]

(c) A multiplexer has two signal inputs (labelled A and B), a select input (S) and one output (Z). Input A is selected when S is a logic low, and input B is selected when S is a logic high. Draw a Truth Table showing the logical operation of this device. By means of your Truth Table write down the Boolean expression describing the logical function of the multiplexer. From this expression draw a circuit diagram showing how the multiplexer may be implemented using only NAND and OR gates.

[10 marks]

(d) A microprocessor uses a 10MHz clock. Calculate the period of this waveform.

[5 marks]