



INSTITUTE OF TECHNOLOGY - TRALEE

B.Sc. (Hons) & (Ord) Computing with Games Development
B.Sc. (Hons) & (Ord) Computing with Multimedia
B.Sc. (Hons) & (Ord) Computing with Software Development

STAGE ONE
SEMESTER 2 EXAMINATION 2008/2009

Computer Architecture

External Examiner: Dr. B. Feeney
Internal Examiner: Ms. M. O'Sullivan

Duration of Exam: 2 Hours

Instructions to Candidates: Answer **any three** questions.

Question One

33 Marks

- (a) Convert the decimal number 60 to its binary and hexadecimal equivalent. (8 Marks)
- (b) Show the logic symbol **and** the truth table for: (8 Marks)
- (i) XOR gate (2 input) (ii) AND gate (3 input)
- (c) Complete the truth table for the expression below: (9 Marks)

$$Z = \overline{A}\overline{B} + C(\overline{A + D})$$

- (d) Draw the circuit for the expression below: (8 Marks)

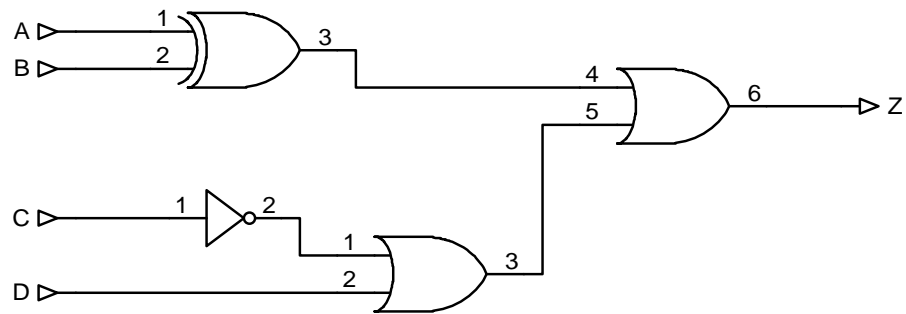
$$Z = \overline{(A + B)} + \overline{C}D$$

Question Two

(33 Marks)

- (a) Write an expression for the circuit given below:

(8 Marks)



- (b) Show the logic symbol and the truth table for the Full Adder.

(8 Marks)

- (c) Design a circuit which outputs a one when input one is at opposite value to input 3 (i.e. in logic value).

(8 Marks)

- (d) Write an expression for Z below. Simplify the expression if possible and draw the circuit. (9 Mar)

(9 Marks)

| A | B | C | Z |
|---|---|---|----------|
| 0 | 0 | 0 | 0 |
| 0 | 0 | 1 | 0 |
| 0 | 1 | 0 | 1 |
| 0 | 1 | 1 | 1 |
| 1 | 0 | 0 | 0 |
| 1 | 0 | 1 | 0 |
| 1 | 1 | 0 | 1 |
| 1 | 1 | 1 | 1 |

Question Three**(33 Marks)**

- (a) How many locations in memory can be addressed by a CPU which has a 24-bit address bus.
(8 Marks)
- (b) Show how four flip-flops can be connected to form a parallel-in serial-out register. Show how 1011 would be loaded into and read from such a register.
(8 Marks)
- (c) Write a short note on Random Access Memory (RAM), discussing Static-RAM and Dynamic-RAM and highlighting the differences between them. How does ROM differ from RAM?
(9 Marks)
- (d) Explain, with the aid of a diagram, how serial data is transmitted.
(8 Marks)

Question Four**(33 Marks)**

- (a) Draw a block diagram of a generic CPU, and write a short paragraph describing the function of each component.
(8 marks)
- (b) A clock operates at a frequency of 120MHz, what is the cycle length in nanoseconds
(8 marks)
- (c) Use Two's Complement Arithmetic to subtract 37 from 26.
(9 Marks)
- (d) Name the groups of registers in the 8086.
(8 Marks)

Rules of Boolean Algebra

| | |
|----|-------------------------------|
| 1 | $A + 0 = A$ |
| 2 | $A + 1 = 1$ |
| 3 | $A \cdot 0 = 0$ |
| 4 | $A \cdot 1 = A$ |
| 5 | $A + A = A$ |
| 6 | $A + \overline{A} = 1$ |
| 7 | $A \cdot A = A$ |
| 8 | $A \cdot \overline{A} = 0$ |
| 9 | $\overline{\overline{A}} = A$ |
| 10 | $A + AB = A$ |
| 11 | $A + \overline{A}B = A + B$ |
| 12 | $(A + B)(A + C) = A + BC$ |

Laws of Boolean Algebra

| | |
|--------------|--|
| Commutative | $A + B = B + A$ $AB = BA$ |
| Associative | $A + (B + C) = (A + B) + C$ $A(BC) = (AB)C$ |
| Distributive | $A(B + C) = AB + AC$ |

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