# BAHRIA UNIVERSITY (KARACHI CAMPUS)

FINAL TERM EXAMINATION – FALL SEMESTER - 2020

## COMPUTER ARCHITECTURE & ORGANIZATION (CEN – 221)

Class: **BSE-3A, BSE-3B** **Morning**

Course Instructor: **Dr. Syed Samar Yazdani** Time Allowed: **2.5 Hours**

Date: **11th February 2021** Session**: II** Max Marks: **50 Marks**

Student's Name: _____ Reg. No: _____

**Note:**

- *Attempt all questions*

**Question 1** [CLO 1]

Answer the following questions. **[**10 Marks**]**

a. Draw Von Neumann Architecture with the diagram.
b. Define Cache Memory.
c. How a virtual address does get translated into a physical address?
d. Differentiate between RISC & CISC architecture.
e. Define the general register organization.
f. Define the Floating point representation.
g. Define the Flynn's Classification.
h. Define computer architecture and computer organization.
i. List and briefly define three techniques for performing I/O.
j. Define DMA?

**Question 2** [CLO 5] [8 Marks]

a. Our favorite program run in 10 seconds on computer A, which has a 2 GHz clock. We are trying to help a computer designer build a computer B, that will run this program in 6 seconds. The designer has determined that a substantial increase in the clock rate is possible, but this increase will affect the rest of the CPU design, causing computer B to require 1.2 times as many clock cycles as computer A for this program. What clock rate should we tell the designer to target? [4 Marks]
b. Suppose we have two implementations of the same instruction set architecture. Computer A has a clock cycle time of 250 ps and a CPI of 2.0 for some program, and computer B has a clock cycle time of 500 ps and a CPI of 1.2 for the same program. Which computer is faster for this program, and by how much? [4 Marks]

**Question 3** [CLO 3 & 6] [8 Marks]

a. Describe how to determine if a number is negative in the following representations: sign magnitude, twos complement. [2 Marks]
b. Draw and explain the hardware for Booth Algorithm, its flow chart for 2's complement number multiplication. Multiply 0111 & 0011 with the help of Booth's algorithm. [6 Marks]

Q.No.4 [CLO 2 & 3] [8 Marks]

(a) Convert the following binary to their decimal equivalents: [2 Marks]

a. 11100.011 b. 110011.10011

(b) Compute the effective CPI for MIPS using Figure below. Assume we have made the following measurements of average CPI for instruction types: [6 Marks]

| Instruction | Clock Cycles |
|---|---|
| All ALU instructions | 1.0 |
| Loads-Stores | 1.4 |
| Conditional Branches | |
| Taken | 2.0 |
| Not taken | 1.5 |
| Jumps | 1.2 |

| Instruction | Average of gap and gcc % |
|---|---|
| load | 25.8 |
| store | 11.8 |
| add | 20.0 |
| sub | 2.0 |
| mul | 0.8 |
| compare | 4.4 |
| load imm | 3.6 |
| cond branch | 10.7 |
| cond move | 0.5 |
| jump | 0.8 |
| call | 1.1 |
| return | 1.1 |
| shift | 2.4 |
| and | 4.4 |
| or | 8.2 |
| xor | 2.0 |
| other logical | 0.2 |

- Assume that 60% of the conditional branches are taken and that all instructions in the "other" category of the above given figure are ALU instructions. Average the instruction frequencies of **gap** and **gcc** to obtain the instruction mix?

Q.No.5 [CLO 4 & 6] [8 Marks]

(a) Represent the following decimal numbers in both binary sign/magnitude and two's complement using 16 bits: +512; -29 [4 Marks]

(b) Convert the following decimal numbers to their binary equivalents: [4 Marks]

a. 64 b. 100 c. 111 d. 145

Q.No.6 [CLO 4 & 6] [8 Marks]

(a) Construct a truth table for the following Boolean expressions: [4 Marks]

1. ABC + $\bar{A}\ \bar{B}\ \bar{C}$
2. $ABC + A\bar{B}\bar{C} + \bar{A}\ \bar{B}\ \bar{C}$
3. $A(B\bar{C} + \bar{B}C)$
4. $(A + B)(A + C)(\bar{A} + \bar{B})$

(b) Simplify the following expressions according to the commutative law: [2 Marks]

1. $A\,.\,\bar{B} + \bar{B}\,.\,A + C\,.\,D\,.\,E + \bar{C}\,.\,D\,.\,E + E\,.\,\bar{C}\,.\,D$
2. $A\,.\,B + A\,.\,C + B\,.\,A$

(c ) Apply DeMorgan's theorem to the following equations: [2 Marks]

1. $F = V + \bar{A} + L$
2. $F = \bar{A} + \bar{B} + \bar{C} + \bar{D}$