CSE2201- Computer Organization
Final Examination (Questions and Answers)
Dr. N AYDIN
n.aydin@bahcesehir.edu.tr

Q1. What are the major structural components of a CPU. Briefly explain them

A1. Control unit (CU): Controls the operation of the CPU
ALU: Performs the computer's data processing functions
Registers: Provides storage internal to the CPU
CPU interconnection: provides communication among CU, ALU, and registers

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Q2. Consider a hypothetical 64-bit microprocessor having 64-bit instructions composed of two fields: The first word contains the op-code and the remainder an address.
a. What is the maximum directly addressable memory capacity?
b. How many bits are needed for the program counter and the instruction register?

A2. a. 2^{48}
b. The program counter must be at least 48 bits. If the instruction register is to contain the whole instruction, it will have to be 64-bits long.

Q3. Write the memory hierarchy in a computer system.

A3. Registers; L1 Cache; L2 Cache; Main memory; Disk cache; Disk; Optical; Tape

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Q4. A set associative cache consists of 64 lines, or slots, divided into four-line sets. Main memory contains 4K blocks of 128 words each. Show the format of main memory addresses.

A4. The cache is divided into 16 sets of 4 lines each. Therefore, 4 bits are needed to identify the set number. Main memory consists of 4K = 2^{12} blocks. Therefore, the set plus tag lengths must be 12 bits and therefore the tag length is 8 bits. Each block contains 128 words. Therefore, 7 bits are needed to specify the word.

	TAG	*SET*	*WORD*
Main memory address =	*8*	*4*	*7*

Q5. a. What are the basic elements of a processor?
b. Write types of micro-operations in a processor.

A5. a. ALU; Registers; Internal data paths; External data paths; Control Unit
b. Transfer data between registers
Transfer data from register to external
Transfer data from external to register
Perform arithmetic or logical ops

Q6. a. What are the major functions or requirements for an I/O module
b. Write principle I/O techniques used in a computer systems.

A6. a. Control & Timing
CPU Communication
Device Communication
Data Buffering
Error Detection
b. Programmed; Interrupt driven; Direct Memory Access (DMA)

Q7. For the given minimized function $F = AB + \overline{A}\overline{B} + C$,
a. form the truth table.
b. write the original function (before the minimization) from the truth table.

A7. a.

A	B	C	AB	$\overline{A}\overline{B}$	$AB+\overline{A}\overline{B}+C$
0	0	0	0	1	1
0	0	1	0	1	1
0	1	0	0	0	0
0	1	1	0	0	1
1	0	0	0	0	0
1	0	1	0	0	1
1	1	0	1	0	1
1	1	1	1	0	1

b. $F = \overline{A}\overline{B}\overline{C} + \overline{A}\overline{B}C + \overline{A}BC + A\overline{B}C + AB\overline{C} + ABC$

Q8. a. Convert the binary number 11100.011 to corresponding decimal number.
b. Convert the decimal number 631.25 to corresponding hexadecimal number.

A8. a. 28.375; b. 277.4

Q9. Given the following memory values and a one-address machine with an accumulator, what values do the following instructions load into the accumulator?
Word 20 contains 40; Word 30 contains 50; Word 40 contains 60; Word 50 contains 70

a. LOAD IMMEDIATE 20
b. LOAD DIRECT 20
c. LOAD INDIRECT 20
d. LOAD IMMEDIATE 30
e. LOAD DIRECT 30

A9. a. 20 b. 40 c. 60 d. 30 e. 50

Q10. Consider the following operation on a binary word: Start with the least significant bit. Copy all bits that are zero until the first bit, which is one, is reached and copy that bit too. Then take complement of each bit thereafter. What is the result?

A10. The twos complement of the original number.