



**METRO STATE  
UNIVERSITY**

**ICS 232 Computer Organization & Architecture  
Mid-Term Exam Review**

You may use up to 10 pages of single-side notes and the textbook. You may not use a computer, phone, calculator, or any other electronic equipment except to compile and run exam questions and to look up ASCII / Unicode characters.

1. Memory organization / hierarchy.
  - a. Registers
  - b. L1, L2 cache
  - c. RAM
  - d. Disk
  - e. Memory Interleaving
2. Measurement systems: storage sizes and timing
  - a. KB, MB, GB, TB
  - b. ns,  $\mu$ s, ms, sec
3. Numeric conversions:
  - a. binary conversions - ones complement, twos complement
  - b. Hex addition / subtraction
  - c. Big vs Little Endian
  - d. IEEE floating point
4. Ranges of numbers in signed and unsigned
5. ASCII / Unicode conversion
6. Instruction execution: Fetch, Decode, Execute
7. Design a circuit from a boolean expression
8. From a circuit what is the boolean expression
9. Give a truth table for a boolean expression
10. MARIE programming

```
if (A > 5)
```



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B = 6;

A = A + 3 - (C + 4)

LOAD A

ADD Three

SUBT C

SUBT Four

STORE A

HALT

A, DEC 10

C, DEC 12

Three, DEC 3

Four, DEC 4

11. Simple C program

12. RISC vs CISC differences

- a. Fixed vs Variable Length Instructions
- b. RISC has large number of registers
- c. RISC is a load/store architecture
- d. RISC has smaller number of instructions

13. Types of I/O: memory-mapped I/O and instruction-based I/O

14. Types of interrupts and how they are handled

15. RPN:

A + B / C - 4 (infix)

A B C / + 4 - (postfix)

Examples:

-99<sub>10</sub> to hex 2-complement.

99 / 2 = 49 r 1

49 / 2 = 24 r 1



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```
24 / 2 = 12 r 0
12 / 2 = 6 r 0
6 / 2 = 3 r 0
3 / 2 = 1 r 1
1 / 2 = 0 r 1
```

```
0 1 1 0 0 0 1 1 = 6316
1 0 0 1 1 1 0 0 = one's complement
                    +1
1 0 0 1 1 1 0 1 = 9D16
```

**0.125<sub>10</sub> to binary and hex**

```
0.125 * 2 = 0.250
0.250 * 2 = 0.500
0.500 * 2 = 1.000
0.000
```

$.0010_2 = 0.2_{16}$

**Hex arithmetic**

```
1
9A4C
+16B2
=====
B0FE
3210
```

$11 * 16^3 + 0 * 16^2 + 15 * 16^1 + 14 * 16^0 = 45310$

**Big Endian**

00 00 B0 FE

**Little Endian**

FE B0 00 00

**Character representation**



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"789 a π"

ASCII = 37 38 39 20 61 20 ??

Unicode = 0037 0038 0039 0020 0061 0020 03C0

Unicode (little) = 3700 3800 3900 2000 6100 2000 C003

IEEE Single Precision floating point

12.75

$1100.11_2$

$1.10011 \times 2^3$

$0\ 10000010\ 100110000000000000000000_2$

$414c0000_{16}$

-99.50

$01100011.1000_2$

$1.1000111000_2 \times 2^6$

$1\ 10000101\ 1000111000\dots00_2$