

## Computer Architecture ECE314

### Winter 2004 Test 2

1. Identify the following terms or abbreviations (2 points each)
  - (a) ASM
  - (b) chip select (CS)
  - (c) EEPROM
  - (d) gated clock
2. Explain the difference in how information is stored in dynamic RAM compared to static RAM? (4 points)
3. What additional operation(s) must be performed for dynamic RAM that is not necessary for static RAM? (4 points)
4. Find the value  $R1 \leftarrow R2 \text{ sl } 3$  if  $R2 = 00101011$ . (3 points)
5. How many megabytes of memory are available in a RAM with a 12-bit address and 16-bit output? (4 points)
6. How many 64K \* 4 bit RAM chips are necessary in order to construct 2 M \* 16 bit memory? (4 points)
7. Describe at least four kinds of memory (or storage) and rank them by capacity and/or access time. (4 points)
8. Given an example of each of the following kinds of microoperations. (3 points)
  - (a) arithmetic
  - (b) logical
  - (c) shift

9. Name and describe the function of the following registers (e.g. ACC is the accumulator) (2 points each)

(a) ACC

(b) PC

(c) IR

(d) MAR

(e) MDR

10. Identify the three states found in the operation cycle of most computers. (3 points)

(a) F \_\_\_\_\_

(b) D \_\_\_\_\_

(c) E \_\_\_\_\_

11. Describe the following operand addressing modes. (3 points)

(a) Immediate (e.g. LOADI)

(b) Direct (e.g. LOAD)

(c) Indirect (e.g. LOADM)

12. Given the following addresses and contents (all in hex)

address	contents
20	24
22	20
24	22

Find the contents of the accumulator after each of the following operations. (6 points)

(a) LOADI 20

(b) LOAD 22

(c) LOADM 24

13. What microoperation(s) would you use to transfer the last three bits of R2 into R3? All other bits of R3 should be zero. Express your answer as a register transfer. (2 points)

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14. Given the 16-bit accumulator 0011 1110 1010 0111 what operation must be performed and what operand must be used for the following. Assume bit positions are 15 through 0 from left to right. (2 points each)
  - (a) Clear all even bit positions to 0.
  - (b) Set the leftmost 4 bits to 1.
  - (c) Complement the center 8 bits.
15. Find the ASM chart corresponding to the following description: There are two states, A and B. If in state A and input X is 1, then the next state is A. If in state A and input X is 0, then the next state is B. If in state B and input Y is 0, then the next state is B. If in state B and input Y is 1, then the next state is A. Output Z is equal to 1 while the circuit is in state B. (6 points)
16. Multiply the two unsigned binary numbers 10101 (multiplicand) and 1101 (multiplier). (4 points)
17. Briefly describe the significant features of each of the following types of memory (2 points each)
  - (a) FPM DRAM
  - (b) EDO DRAM
  - (c) DDR SDRAM
  - (d) RDRAM
18. A DRAM has a refresh interval of 98 ms and has 2048 rows. What is the interval between refreshes for distributed refresh? What is the minimum number of address pins on the DRAM? (4 points)
19. Write an assembly language program to calculate the average of the contents of address A and address C and store the results in address G. (Note division by two corresponds to a right shift of one bit). (6 points)

20. What is the hex value in the accumulator (memory address F) at the end of execution. Show your reasoning at each step for partial credit. (8 points)

```
TITLE  TEST EXAMPLE
;*****
; PROGRAM AREA
;*****
    ORG H#00
START: LOAD B%:
        ADD  D%:
        STORE E%:
        LOAD A%:
LA:     ADDI  H#03
        SUBT E%:
        JPOS LB%:
        ADD  B%:
LB:     STORE F%:
        ADD  C%:
        JNEG LA%:
        LOAD F%:
        JUMP $%:
;*****
; DATA FOR TEST PROGRAM
;*****
    ORG H#20
A:     DW H#0038
B:     DW H#001C
C:     DW H#0014
D:     DW H#0007
E:     DW H#0012
F:     DW H#0000
END
```