MSTC – Question Set II

Computer Architecture – MSTC Machine Language – Assembly Language

1. How many registers does MSTC microprocessor has?

2. How many minimum operands and MSTC microprocessor instruction can take and how many maximum operands MSTC microprocessor instruction can take?

3. State three rules which govern combination of operands on MSTC instruction.

4. Explain with example: machine language format, possible operand types and size requirement of MSTC instruction accepting one operand.

5. Explain with example: machine language format, possible operand types and size requirement of MSTC instruction accepting two operands.

6. Explain with example: machine language format, possible operand types and size requirement of MSTC instruction accepting three operands.

7. Explain the rationale behind rule 1 of operand combination which states size of source must be equal to size of destination.

8. Explain the rational behind rule 2 operand combination which states that destination operand cannot be an immediate operand.

9. Explain the rational behind rule 3 of operand combination which states that both cannot be memory locations simultaneously.

10. All three operands types are internally represented as numbers. How does MSTC microprocessor understand the operand type? (More explicitly how does MSTC microprocessor understand whether operand 3 is immediate 3, register whose number is 3 or memory address 3?)

11. Explain five classical components of computer and explain each one of them in brief.

12. Explain the input subsystem of a computer and explain the flow of data input from keyboard to main memory using keyboard example (refer to class discussion for the same)

13. Explain the output subsystem of a computer and explain the flow of data output from main memory on console (monitor). (refer to class discussion for

the same)

14. Why secondary storage is not a part of five classical components of computer architecture?

15. Explain memory hierarchy pyramid by commenting on every type of memory in hierarchy. Also analyse the levels in pyramid based on quantity vis-à-vis cost vis-à-vis access time.

16. Give brief overview of implementation technology of memory devices and microprocessors. (Refer: Computer Organization: A hardware / software interface, Chapter 1)

17. State and explain the three equation which yield the cost of integrated circuits. (Not covered in class. (Refer: Computer Organization: A hardware / software interface, Chapter 1)

18. Explain the fundamental parameters of computer performance. ((Refer: Computer Organization: A hardware / software interface, Chapter 1).

19. State and explain the equations which measure CPU performance and instruction performance. (Refer: Computer Organization: A hardware / software interface, Chapter 1)

20. Comment on CISC architecture. What traits in MSTC microprocessor are CISC like? Justify your answers. [Refer authentic web sources + any standard book on Computer Organization in the book list given]

21. Comment on RISC architecture. What traits in MSTC microprocessor are RISC like? Justify your answers. [Refer authentic web sources + any standard book on computer organization]

22. Explain and justify following statement. The current Intel instruction set is CISC outwardly but RISC inwardly. [Refer 'x86 instruction set architecture' book by Tom Shanley for constructing your answer]

23. Name any three CISC architectures. [You may have dig into early generation microprocessors]

24. Name any three RISC architectures.

25. Explain the concept of data-path. [Refer course lectures]

26. Explain the role of control unit/control path. [Refer course lectures]

27. Explain role of data bust, address bus and control bus.

28. Explain CPU read cycle in depth. [Refer course lectures]

29. Explain CPU write cycle in depth. [Refer course lectures]

30. Explain role of BE0, BE1, BE2, BE3 pins in Intel 80386 architectures. [Refer course lectures]

31. What operations are typically implemented in modern ALU? [Refer to authentic web sources]

32. What is data bus? What is bus architecture? Briefly collect information about ISA, EISA and PCI and summarise it for yourself. Which bus architecture is found in contemporary PC's?

33. Explain the difference between uniprocessor and multiprocessor systems.

34. Explain the difference between multiprocessor and multicore systems.

35. Explain the difference between symmetric multiprocessor systems and Nonuniform memory architecture.

36. Case study: Take at least one super-computer of your choice. (If you do not know about one then search on authentic web sources). Study its internal architecture block diagram at high level (i.e. you need not understand every bit of detail in it). What are the salient points of differences between the architecture of typical desktop computer and a super – computer?

37. Comment on following, "Grid computing as a means of availing the power of super-computing at desktop". [Not covered in course. You are completely on your own for this question]

38. What is physical package with respect to microprocessor?

39. What is physical core with respect to microprocessor?

40. What is logical core with respect to microprocessor?

41. What is hyper-threading?

42. Explain Intel nomenclature with all salient phases in between from Intel 4004 to Intel Core I7 10th Generation CPU.

43. As a part of adding a Floating-Point Unit to MSTC microprocessor, design and add floating point registers. Design decisions that you must take:
    a. Precision levels that you want to support.
    b. Size of every register in bit
    c. Number of registers.

44. As a part of adding a Floating-point unit to MSTC microprocessor, design following new instructions to FPU instruction set. For each new instruction you must take into consideration the following:
    a. Unique OPCODE
    b. How many operands are required by OPCODE (ary of operator)
    c. What are the operand combinations?
    d. In what operand result of an operation will be available?
    Support following operations:
    a. Data movement (from FPU -> Memory & Memory -> FPU) of Precision Type #1.
    b. Data movement (from FPU -> Memory & Memory -> FPU) of Precision Type #2.
    c. floating point addition
    d. floating point subtraction
    e. floating point multiplication
    f. floating point division
    g. floating point log to the base 10
    h. floating point log to the base 2
    i. power of float x to integer n
    j. (1/f) of given floating point number f.
    k. power of float x to float n.
    l. sin of angle given in radians
    m. cos of angle given in radians
    n. tan of angle given in radians
    o. cot of angle given in radians
    p. sec of angle given in radians
    q. cosec of angle given in radians
    r. Load constant Pi in given FPU register.
    s. Floor of a given floating point number
    t. Ceiling of a given floating point number
    u. Truncated version of given floating point number
    v. Absolute value of given floating pointer number.

45. Search and comment on SIMD, MIMD architectures. What are their advantages? Does Intel support SIMD? If yes, then through which registers? Does Intel support MIMD? If yes, then through which registers?

46. Add following instructions to CPU instruction set. While designing new instructions you must take into consider the same parameters as in Question 44.
    a. Logical and
    b. Logical or
    c. Logical not
    d. Bitwise and
    e. Bitwise or
    f. Bitwise xor
    g. Shift arithmetic left

h. Shift arithmetic right

Machine Language Programs

Machine's Language = MSTC Microprocessor Machine Language

47. Write a machine's language program to calculate area of circle. [Radius = 5.5 units]. (Please refer to machine language program and follow the same method to write your solutions i.e. write a logic in abstract notations first and then write a machine language instruction corresponding to each step)

48. Write a machine's language program to calculate the area of triangle whose three sides are viz. a = 4.5units, b=5.4units, c=6.5 units, using a following formula, A(Triangle) = sqrt(s * (s – a) * (s – b) * (s – c)) where s = (a+b+c)/2.

49. Write a machine's language program to calculate the area of quadrilateral whose sides are viz. a = 10.5, b=20.5, c=21.5, d=30.3 units, using following formula, A(Quadrilateral) = sqrt((s – a) * (s – b) * (s – c) * (s – d)) where s = (a+b+c+d)/2.

50. Write a machine's language program to calculate the length of a diagonal of a square whose length is 10 units.

51. Write a machine's language program to calculate the hypotenuse of a right-angled triangle whose base is 4 units and whose height is 3 units. [Hint: use Pythagoras Theorem]

52. Write a machine's language program to calculate the base of a right-angled triangle whose hypotenuse is 10 units long and height is 8 units. [Hint: Use Pythagoras Theorem]

53. Write a machine's language program to calculate arithmetic mean of following numbers