Intro to Processor Architecture Quiz
(Spring 2023)

Date: 3/2/2023 Marks: 35

Time : 40 mins

Instructions

For MCQs, there is a negative marking of -0.25 for each wrong answer given. Each correct answer will get marks proportional to the total marks for the question. If every choice is marked, you will get negative making of -1.

1) What is/are true about an Instruction Set Architecture (ISA)? **(2 marks)**
   a) It defines the modes in which operands of an instruction can be addressed.
   b) It does not affect the complexity of instructions.
   c) It allocates memory resources for a software program.
   d) Hardware implementation for an ISA is not unique.

2) Using Y86-64 ISA and a special instruction you can define, write an assembly program to perform matrix dot product of two 1x5 vectors, where one of the vectors has all elements with value of 16. The elements of each matrix are stored in contiguous locations in memory. You can assume which register holds the base address value of each matrix location in memory. The result can be stored in registers. **(5 marks)**

3) Which of the following instructions modify the stack pointer? **(2 marks)**
   a) ret
   b) jne
   c) movq
   d) call

4) Which of the following instructions can alter the program counter normal increments? **(2 marks)**
   a) cmovle
   b) jle
   c) ret
   d) movq

5) Which of the following instructions results in writing a value read from memory into a register? **(2 marks)**
   a) rmmovq
   b) popq
   c) leaq
   d) ret

6) Which of the following addressing modes is helpful to work with arrays? **(2 marks)**
   a) movq (%rbp),%rax

b) movq 16(%rbp),%rax
c) movq (%rbp,%rdi),%rax
d) movq %rdx,%rax

7) How does the code statement "*p = y;" translate to in assembly language? **(2 marks)**
a) movq (%rbx), %rax
b) movq %rbx, %rax
c) movq %rax, (%rbx)
d) None of the above

8) What is the effective address when the addressing mode is 0x10(%rdx, %rax, 8), when %rdx = 0x04 and %rax = 0x01? **(2 marks)**
a) 0x1a
b) 0x1b
c) 0x1c
d) 0x1d

9) Briefly explain what a Y86-64 instruction decoder performs when presented with the following Y86-64 instructions?
i) irmovq V, rB
ii) jXX $0x1030
Only highlight the essential components that are extracted with figure of instruction format and without too much verbose explanation. **(5 marks)**

10) What is the machine encoding for the Y86-64 instruction irmovq $0x100a34, %rcx? **(2 marks)**
a) 30 81 34 0a 10 00
b) 30 F1 34 0a 10 00
c) 30 81 00 10 0a 34
d) 30 F1 00 10 0a 34

11) What is/are true about the programming abstractions? **(2 marks)**
a) A high level programming language has better access to the registers in a processor.
b) Assembly language programming is the easiest in terms of programmability.
c) Machine code generated in an executable can be relocated in memory.
d) None of the above

12) Suppose there exists a compiler which can translate a program to exploit two architectures A1 and A2 (the best implementations of both). If the compiled machine code works with higher performance for the same set of inputs on architecture A2 always, what conclusions may be true? **(2 marks)**
a) A1 is Von Neumann Architecture and A2 is Harvard Architecture
b) A2 is Von Neumann Architecture and A1 is Harvard Architecture

c) Both are Von Neumann Architectures
d) Both are Harvard Architectures

13) Please explain the push and pop instructions briefly showing the stack manipulations. (5 marks)