Intro to Processor Architecture
Quiz
(Spring 2024)

Date: 29/1/2023 Marks: 30
**Time : 40 mins**

Instructions
For MCQs,
There is a negative marking of -0.25 for each wrong answer given. If more choices than the number of correct choices is marked, then you get -1. Each correct answer will get proportional marks based on number of correct choices.

For descriptive questions, give concise answers highlighting the main points.

1) Explain the call and ret instruction execution with the help of an example. **(5 marks)**

2) Write the assembly language program to compute the Fibonacci sequence for first 20 terms. You can assume that the initial 2 numbers are stored in contiguous locations in memory that can be referenced using address value in register %rbx. The subsequent numbers in the series have to be written back to memory. Write a code as compact as possible. (The x86-64 instructions and addressing modes can be used) **(5 marks)**

3) How does the code statement "y = *p;" translate to in assembly language? **(1 mark)**
   a) movq (%rbx), %rax
   b) movq %rbx, %rax
   c) movq %rax, (%rbx)
   d) None of the above

4) Which of the following instructions can assign the program counter a value from the stack? **(1 mark)**
   a) pushq
   b) popq
   c) ret
   d) All of the above

5) Which of the following instructions can modify the condition code register? **(1 mark)**
   a) addq
   b) incq
   c) leaq
   d) All of the above

6) Please explain with an example (you can use the high-level language and need not write the assembly language code) how the switch case construct is translated into assembly language program. **(5 marks)**

7) It is given that the OS has assigned the address space between 0x2000 and 0x2FFF for some kernel processes. What would happen if an instruction in a user program does the following? **(3 marks)**

```
%rbp – 0x2010, %rcx - 10
movq %rcx, (%rbp)
```

8) Which of the following instructions do not alter the normal increments of the program counter? **(1 mark)**

a) pushq
b) call
c) jne
d) None of the above

9) Why is cmov instruction used instead of conditional jumps whenever appropriate? What is the condition in which it will not be feasible to use cmov instruction and a conditional jump is preferred by the compiler? **(4 marks)**

10) Which of the following addressing modes works best for array of structs? **(1 mark)**

a) movq (%rbp),%rax
b) movq D(%rbp),%rax
c) movq D(%rbp,%rdi,S),%rax
d) movq %rdx,(%rax)

11) Briefly explain how a Y86-64 instruction decoder extracts information from the following instructions? (You need not remember the exact opcode values to answer) **(3 marks)**

i) OPq %rcx, %rax
ii) jXX $0x1030

Only highlight the essential components that are extracted with figure of instruction format. **(5 marks)**