2021 Fall CPSC 240-5

Midterm Concepts Test #1 Answers

27 Sept 2021: 1:00pm – 4:30pm

Take Home Test

Read me

Place your answers in the space following each question.

Place your name in the test either in this front page or on the last page or both.

Near 2:50pm begin to save your test document in either odt, or doc, or docx format.

Before 2:59pm send your document as an attachment to me: holliday@fullerton.edu

If you encounter a question where you feel that you must guess an answer then place the word “Blank” in the space for the answer and you will receive 20% of the credit for that question.

If the answer space is empty then the points for that question are zero.

You may use any word processing tool at your disposal provided it can save files in one of the three accepted formats.

If your computer has no word processor program then try Google Docs, which saves files in every format ever created on this planet.

The total point value of this test is 100 points, which is one-sixth of your course grade.

Every effort has been made to create unambiguous questions. If a question is truly ambiguous send me ordinary email or a chat message to ask for clarification. I will be at computer during the test period probably answering the backlog of email.

This is an open note test. Use any tools that work for you such as:

- recordings of lectures
- class notes
- ebooks
- calculators
- internet

Proceed to the next page.

1. In the area of computer architecture what is the size of a dword? [3]

Answer = 4 bytes or 32 bits

2. Where is cache? [3]
   a. In RAM
   b. In EPROM attached to the motherboard
   c. In CMOS also attached to the motherboard
   d. In solid state drive (SSD)
   e. None of above

Answer: None of above. Cache is inside the microprocessor

3. Here is a register rax = ABCD EF09 8765 4321
Suppose we execute the instruction cqo. What will happen? [3]

Answer: rax does not change, but rdx becomes FFFF FFFF FFFF FFFF

Comments: Everyone wrote ""create a 128 bit number out of the given rax" or wrote similar words expressing the same thought. But that is superficial knowledge of little value. Stating that a number expands to 128 bits does not help a programmer. This entire course is generally focused on what do you do with bits. This question wants to know what do you do with the bits when you encounter a negative number like rax.

4. Suppose you are working with word size twos-complement integers. What is the largest integer is this system? Give the answer in decimal. Calculators may be used. [3]

Answer: 2^15 – 1 which is 32767.

5. What is the size in bits of a complete xmm register? [3]

Answer: The complete register contains 128 bits.

6. What is -2928 in a 32-bit register? [6]
[Plugging this into a calculator wins no points. You must show me a large portion of your mathematical work. There should be sufficient math to convince me you know what you're doing.]

Answer: Begin with the positive number 2928 and begin dividing by 2.

2928/2 = 1464 R 0
1464/2 = 732 R 0
732/2 = 366 R 0
366/2 = 183 R 0
183/2 = 91 R 1
91/2 = 45 R 1
45/2 = 22 R 1
22/2 = 11 R 0
11/2 = 5 R 1
5/2 = 2 R 1
2/2 = 1 R 0
1/2 = 0 R 1
Stop

Therefore 2927 = 101101110000
= 0000 0000 0000 0000 0000 1011 0111 0000
Now find the negative of the number above.
The complement of 2927 is 1111 1111 1111 1111 1111 0100 1000 1111
Now add 1: -2927 = 1111 1111 1111 1111 1111 0100 1001 0000

Final answer is -2927 = FFFF F490

7. Name (or describe) something that the ALU commonly does. [3]

Answer: The ALU performs math and logic operations such as subsd xmm3,xmm4

8. Give the name of a computer architecture that is not Von Neumann. [3]

Answer: Quantum also Harvard

9. What is the page number in the textbook where we can find the name of the lower 32 bits of register r12? [3]

Answer: page 10 <==== r12 is not mentioned on page 11.

10. Place the following in order from low memory address to high memory address. [3]

1 system stack
2 executing application program
3 data declared in segment .bss
4 available heap space

Answer: 2, 3, 4, 1

11. Show a fragment of X86 code that implements the following dialog. [11]

Please enter the street address: 2645 Maple Street
The location number is 2645

We assume all house numbers have 4 digits. The text in yellow is inputted by the user.

Answer:

```
segment .data
prompt db “Please enter the street address”,0
info db “The location number is lf”,10,0
string_type db “%s”,0

segment .bss
street resb 128


segment .text

;==== Prompt for the address
mov rax, 0
mov rdi, string_type
mov rsi,prompt
call printf

===== Input the address
mov rax, 0
mov rdi, street
mov rsi, 128
mov rdx, [stdin]
call fgets

===== Exclude the tail, keep the 4 digits
mov [street+4],0

===== Output the short string having only a 4 digit number
mov rax, 0
mov rdi, info
call printf

;Finished
```

12. Show how to declare a constant named max_traffic and give it the value 35. [3]

Answer: max_traffic equ 35

13. We sometimes talk about “the loader” or “the loader function”. Where is that function? [3]

Answer: The loader is module within every operating system.

14. Suppose you are a big fan of the game Extreme Shopping 5. Using techniques of reverse compiling of the executable file you discovered more than a dozen ways to cheat the game. That means that you can keep on shopping even after all your credit cards are maxed out. You created a mini-ebooklet containing all of that information and you plan to upload it to www.cheatcodes.com. What software license do you put on your ebooklet? [3]

Answer: Creative Commons

To be more detailed: Creative Commons provides several different level of freedom in the CC license. One example of a degree of freedom is “BY-NC-SA”

15. Suppose that you used your computer science background to create a program “Ultrazip” that will compress any file into a zip file at a speed faster than any known zipping program. You decide to post your breakthrough product on github in order to share it with the world. What license do you put on that program? [3]

Answer: LGPL

16. Convert 189.375 to the equivalent scientific binary form. [8]
[Plugging this into a calculator will gain you no points. You must show me a large portion of your mathematical work. There should be sufficient math to convince me you know what you're doing.]

Answer: First convert 189 to binary.

189/2 = 94 R 1
94/2 = 47 R 0
47/2 = 23 R 1
23/2 = 11 R 1
11/2 = 5 R 1
5/2 = 2 R 1
2/2 = 1 R 0
1/2 = 0 R 1
stop

Therefore, 189 = 10111101

Second convert 0.375 to binary
0.375 x 2 = 0.75
0.75 x 2 = 1.5
0.5 x 2 = 1.0
0.0 x 2 = 0.0
stop

Therefore 0.375 = 0.011

Now put the two results together: 189.375 = 10111101.011 = **1.0111101011 x 2^7**

17. Convert 12.1 to the equivalent scientific binary form. [8]
[You know what to do. Show me your work. A single answer from the calculator does not count.]

Answer: 12 = 1100.

0.1 x 2 = 0.2
0.2 x 2 = 0.4
0.4 x 2 = 0.8
0.8 x 2 = 1.6
0.6 x 2 = 1.2
0.2 x 2 = 0.4
The pattern (yellow) is repeating.

Therefore, 12.1 = 1100.0011 0011 0011 0011 0011 dot dot dot

which equals 1.1000 0011 0011 0011 0011 0011 0011…..x 2^3

Answer: **1.1000 0011 0011 0011 0011 0011 0011…. x 2^3**

18. This declaration appears in a C or C++ function. **double horse = 11.75;**

Show how to use gdb to output the address where horse is stored in hex. That means, the address where 11.75 is stored. [4]

Answer: p/x &horse

Invalid: p/a horse

19. [Continuation from previous question.] Show how to use gdb to output the data value stored in the horse variable as a decimal float number. [4]

Answer: p/f horse

Invalid answers: x/f &horse

20. This declaration appears in a C or C++ function. **char state[ ] = "spooky";**

Show how to use gdb to output the stored data in string format without address number(s). [0]

Answer: p/s state Question 20 was removed from the test.

Invalid answers: p/x &state

21. This declaration appears in a C or C++ function: **char name[ ] = "Marie Currie";**

Use gdb to output the contents of name as individual ascii hex numbers. [4]

Answers: There are more than one correct answer. The first one is preferred because it is simpler.

p/x name
p/x *name@12

Invalid answers p/x &name

22. Use gdb to output the low half of xmm1 as a float number in hex. [4]
[Again, the answer is an example of an IEEE number.]

Answer: p/x $xmm1.v2_int64[0]

Wrong answer: p/x $xmm1.v2_double[0]

23. What is a possible gdb command that could have created the following output? There are more than one answer known to be correct. Any one correct answer will be accepted. [4]

```
0x7fffffffde90:   0x00000000  0x00000000  0xf7c050b3  0x00007fff
0x7fffffffdea0:   0xf7dc9b80  0x00007fff  0xffffdf88  0x00007fff
0x7fffffffdeb0:   0x00011c00  0x00000001  0x00401186  0x00000000
0x7fffffffdec0:   0x004014f0  0x00000000  0xa4a97382  0x7331fc81
0x7fffffffded0:   0x004010a0  0x00000000  0xffffdf80  0x00007fff
0x7fffffffdee0:   0x00000000  0x00000000  0x00000000  0x00000000
0x7fffffffdef0:   0x19e97382  0x8cce037e  0x04677382  0x8cce1301
```

Answer: x/28xw $ rcx //Other correct answers are possible.

Invalid answers x/u $rsp

24. This array was declared in the .data segment: greeting db “Good Morning”,10,0

Use gdb to show the ascii values in decimal of the first 12 bytes of the array. [4]

Answer: x/12db &greeting
Also p/d (char[12])greeting

Invalid answers: p/c greeting

25. [Previous question continued] Use gdb to show the entire string greeting in printable characters. [4]

Answer: p/s (char *)&greeting
Also ok: x/s &greeting

Invalid answers p/c &greeting

The maximum value in points for each question is recorded within square brackets.
Total value of this test is 100 points.

Put your name and your email address on this test someplace

Counting the points:

If you count the total points possible you will discover that the total is 104.

The reason is that one of the questions mistakenly had the answer printed in the answer space. Naturally, everyone used that answer. That's a normal reaction. It was a 4 point question. Everyone gave the same answer. In the end the easiest thing to do was simply to leave the question in place. That is why the mathematical total is really 104.

Since that question has no effect on the curve we will simply leave it there.

Compare your answers with this answer key

If you discover that you were not given credit for one of your answers then contact me and tell me about that question and about your answer. I really like to give back credit for a mistakenly graded question.

This problem often arises with GDB questions. It is common that a GDB question may have 2 or more correct answers. It is difficult for me to know all the correct answers to a GDB question.

If you think one of your GDB answers is in fact correct. Proceed as follows.

> First run any program in GDB mode. If you don't have a program then use one of the posted programs
>
> Place a break point in the middle of either the driver function or in the asm function. When execution reaches the break point then enter your gdb answer. If the result is just what the test question asked for then you have a correct answer. Send me email and tell me which question on your test has the correct answer. I will gladly restore your lost points.

In fact, you should run the gdb check on your answers to all the gdb questions on this test. You don't know how many points you might recover until you try.