**2025 Spring CPSC 240-11**

**Concept Test March 13, 2025: 10:00am-12:00noon**

**Basic info**

The is a 2-hour test. Place your answer for each question in the space directly below the question. You are free to use a word processor to enlarge the space for your answer or reduce the size of the space as given.

The final document must be submitted in one of the three formats: doc, docx, or odt. All other formats will not be read and a zero score will be recorded.

Record your name and other information in the conclusion at the end of this test.

If X86 is required in the answer of question, then each X86 instruction used must appear in the published list of approved instructions.

If you cannot find an answer for any question, then write the word “Blank” without quotes in the space for the answer and you will receive 20% of the credit for that question.

Tests received with a time stamp after 12:05pm will not be read.

The terms IEEE and IEEE754 are used interchangeably.

If a questions requires an algorithmic process to obtain the answer, then give sufficient intermediate steps so that the grader becomes convinced that you know the algorithm.

This is an open notes test. You may use any resource to obtain a answer except obtain a classmate’s answer. That last action will have dire consequences if discovered.

You may find space insufficient for your answer. You may use your word processor to increase the amount of space for an answer if needed.

Continue to next page

1. Who invented (first created) the Linux kernel?

Linus Torvalds

2. Two people together invented the protocols for data transfer between two computers. One inventor received lots of praise for the accomplishment and the other person did a lot of hard work to make the link work, but received little acknowledgment.

What are the names of these two people? First give the name of the acknowledged inventor and then the name of the hard worker.

Vinton Cerf, Robert Kahn

3. Convert -983 to a 16-bit twos-comp 16-bit hex integer. Beware of the negative sign. Show that you know how the algorithm works.

983 ÷ 2 = 491, remainder 1

491 ÷ 2 = 245, remainder 1

245 ÷ 2 = 122, remainder 1

122 ÷ 2 = 61, remainder 0

61 ÷ 2 = 30, remainder 1

30 ÷ 2 = 15, remainder 0

15 ÷ 2 = 7, remainder 1

7 ÷ 2 = 3, remainder 1

3 ÷ 2 = 1, remainder 1

1 ÷ 2 = 0, remainder 1

983₁₀ = 111101011₂

16-bit representation = 0000001111010111₂

0000001111010111 = 1111110000101000 (invert bits)

1111110000101000 + 1 = 1111110000101001

1111 1100 0010 1001 = FC29₁₆

4. In the California desert there is a huge recycling center where used aluminum cans are stored while waiting for the aluminum smelter to be ready for a shipment of cans. Cans are shipped in trucks carrying around 1850 pounds of cans per load. The recycling center estimates that there are several million pound of aluminum waiting for shipment to the smelter.

Here is the problem. Create of block of assembly instructions that will compute how many truck loads will be required to haul all the cans away and compute how pounds will be left over as less than a full truck load.

Given r10 = number of pounds of cargo in one truck

r12 = estimate of total pounds of cans to be hauled away

To be computed: r14 = number of trucks with full loads needed

r15 = number of pounds of left-over cans insufficient to fill one truck.

mov rax, r12

mov rdx, 0

idiv r10

mov r14, rax

mov r15, rdx

5. Begin with IEEE float number 0x0000 CC00 0000 0000

Convert that number to an equivalent decimal expression.

Blank

6. The float number 4.0 is very nice. It has a neighbor or the lower side and on the higher side. Sometimes, 4.0 wants to reach out to its higher neighbor and become friends. How far away is its higher neighbor.

Show your mathemtical work in the space below. Make sure the grader can find your distance answer.

Distance = |5.0 – 4.0| = 1.0

7. The number of bits in a register is often call the width of the register. Suppose you have an integer in edx. Show how to expand edx to rdx and maintain the same numeric value. Use assembly instructions to answer the question.

mov rdx, rdx

8. Show (a block of) assembly instructions that will change bit number 20 in rcx to its opposite value.

mov rax, 1

shl rax, 20

xor rcx, rax

9. Begin with this decimal float number 121.6. Convert it to IEEE 64-bit hex float number. Show your intermediate step so that I know that you know the conversion algorithm.

Blank

========== Conclusion with GDB ============================

10. What GDB command could have created the following output.

0x7fffffffdc50: 0xde68 0xffff 0x7fff 0x0000 0xc4de 0xf78a 0x0001 0x0000

0x7fffffffdc60: 0x0000 0x0000 0x0000 0x0000 0x0000 0x0000 0x0000 0x0000

0x7fffffffdc70: 0x1000 0x0002 0x0000 0x0000 0x7900 0x1bb4 0xc40b 0x9eb4

0x7fffffffdc80: 0x0000 0x0000 0x0000 0x0000 0x11ff 0x0000 0x0000 0x0000

0x7fffffffdc90: 0x11ff 0x0000 0x0000 0x0000 0x0000 0x0000 0x0000 0x0000

0x7fffffffdca0: 0xde78 0xffff 0x7fff

When you know the command run any program in gdb mode. Enter your answer for this question. Make a screen of the result, and paste that output into the space below.

x/30hx 0x7fffffffdc50

11. This array of char has been declared in the main driver.

Char greeting [ ] = “Happy Anniversary”;

What is the gdb command that will output “Anniversary”?

When you know your answer then you have to prove it.

Select a program in your computer. In the drive declare the greeting as shown above. Run the program in gdb mode. Execute past your declaration of greeting. Enter your answer to this question. Make a screen shot of the response from gdb. Paste that response below.

print &greeting[6]

A computer screen with text

AI-generated content may be incorrect.

12. Imagine the xmm2 register is subdivided into 4 double words. Show the gdb command that will output the double word in position 2 in hex.

Next confirm your answer. Run any program in gdb mod. Execute a few statements of the main function. Enter your command. Make a screen shot of the output produced by your command. Paste that screen shot below.

Blank

**Conclusion**

Time expires at 12:00noon + 5 minutes.

Sign your name and your email address. You must include both data items for the test to be graded. Below is space for the information.

Babiker Babiker

bbabiker@csu.fullerton.edu

If this space is left blank or incompletely filled without both data items, then you are agreeing to accept a zero score for this test.

Change the name of the test file by appending your own name to the existing name. Here is an example:

2025spring240-9midterm-concepts.odt

changes to

2025spring240-9midterm-concepts-Allen-Chan.docx

You may convert this document to doc or docx format, or you may keep it in its original format.

Attach this document to an email message that will carry the document physically to me. The email carrier is not required to have a message.

Send to holliday@fullerton.edu

If a link is submitted in place of an attachment, then you are agreeing to accept a score of zero.

Next week classes will resume in person and zoom. The only remaining dates without in-person instruction are test dates.