

CIS 2107
Computer Systems and Low-Level Programming
Spring 2012
Midterm

March 13, 2012

Name: _____

Page	Points	Score
1	8	
2	12	
3	13	
5	13	
7	7	
7	47	
Total:	100	

The exam is closed book, closed notes. You may *not* use a calculator, cell phone, etc.

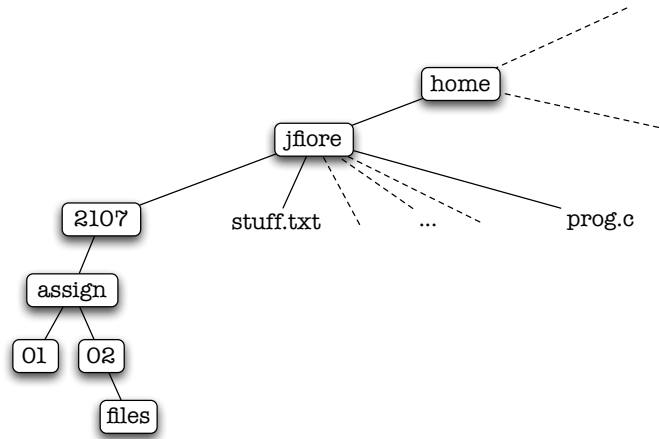
For each of the questions of this quiz, you can assume the following sizes for C data types:

type	bytes
char	1
short	2
int	4
long	8
float	4
double	8
void*	4

Instructions

For the following questions, you can assume that my home directory is the `jfiore` directory.

1. Unix shell stuff.



- (1 point) (a) If I'm in my home directory *i.e.*, `/home/jfiore`, and I run the command `gcc -c prog.c`, what is the name of the resulting file and what does it contain?
-
- (1 point) (b) From any directory, what could you type to change to the parent of your current directory?
-
- (1 point) (c) What command can I type to see a list of all of the files in my current directory?
-
- (1 point) (d) If I'm in my home directory, what's the one command that I can type to put a copy of `prog.c` to the `files` directory inside assignment 2?
-
- (1 point) (e) If I run the command `gcc -E prog.c` to run the preprocessor only on `prog.c`, what does the resulting file contain (*i.e.*, how is it different from `prog.c`)?
-

2. Some conversions.

(1 point) (a) 80 bits = ? kbytes

(a) _____

(1 point) (b) 88 tbytes = ? kbits

(b) _____

(1 point) (c) 2 hours = ? microseconds

(c) _____

(1 point) (d) 128 mbytes = ? kbits

(d) _____

(1 point) (e) 2 minutes = ? milliseconds

(e) _____

3. Convert 215_{10} to:

(2 points) (a) base 2

(1 point) (b) base 16

4. Using the approximation trick that we talked about in class, about how much are each of the following?

(1 point) (a) 2^{33}

(a) _____

(1 point) (b) 2^{17}

(b) _____

(1 point) (c) 2^{49}

(c) _____

(2 points) 5. What is $11011110011_2 + 10011010_2$ in base 2?

$$\begin{array}{r} 1 \ 1 \ 0 \ 1 \ 1 \ 1 \ 1 \ 0 \ 0 \ 1 \ 1_2 \\ + \qquad \qquad \qquad 1 \ 0 \ 0 \ 1 \ 1 \ 0 \ 1 \ 0_2 \\ \hline \end{array}$$

(2 points) 6. What is $F3D6152_{16} + 5A83F3_{16}$ in base 16?

$$\begin{array}{r} F \ 3 \ D \ 6 \ 1 \ 5 \ 2_{16} \\ + \qquad \qquad \qquad 5 \ A \ 8 \ 3 \ F \ 3_{16} \\ \hline \end{array}$$

7. **data representation.** For these questions, please remember to answer in hex, not binary.

(1 point) (a) In hex, what is the smallest integer that can be represented by a 32-bit two's complement int?

(a) _____

(1 point) (b) In hex, what is the largest integer that can be represented by a 32-bit two's complement int?

(b) _____

(1 point) (c) In hex, what is the smallest integer that can be represented by a 32-bit unsigned int?

(c) _____

(1 point) (d) In hex, what is the largest integer that can be represented by a 32-bit unsigned int?

(d) _____

(1 point) (e) In hex, what is -1 as a 32-bit two's complement int?

(e) _____

8. **Some bit operations.** If we have `char x = 0xA9`, `y = 0x2C`; , what is the result of the following operations? Your answer must be in the form of exactly two hex digits¹.

(1 point)

(a) `x|y`

(a) _____

(1 point)

(b) `x||y`

(b) _____

(1 point)

(c) `x<<2`

(c) _____

(1 point)

(d) `~x`

(d) _____

(1 point)

(e) `~~x`

(e) _____

(1 point)

(f) `x & 0x0F`

(f) _____

(1 point)

(g) `x^y`

(g) _____

¹Ignore the possibility of promotion to 32-bit ints. Behave as though we're living in the land of 8-bit arithmetic.

(1 point) (h) $x \& \& 1$

(h) _____

(1 point) (i) $\sim x$

(i) _____

(1 point) (j) $x \sim y$

(j) _____

(1 point) (k) $!!x$

(k) _____

(1 point) (l) $x < 1$

(l) _____

(1 point) (m) $x \& y$

(m) _____

(1 point) (n) x^y

(n) _____

(1 point) (o) $x | y$

(o) _____

- (6 points) 9. For this question, we're doing 4-bit two's complement representation of integers. Fill in the empty boxes in the following table. Addition and subtraction should be performed based on the rules for 4-bit, two's complement arithmetic. Recall that in your book's notation, TMin is defined to be the smallest negative two's complement number that we can represent, and TMax is the largest positive one.

Name	Decimal Rep.	Binary Rep.
Zero	0	0000
n/a	5	
n/a	-4	
n/a		0011
n/a		1101
TMax		
TMin		
TMin+1		
TMax+1		

10. If I have the following:

```
int main(void)
{
    int a=10;
    int b=20;

    int *p=&a;
    int *q=&b;

    a++;
    q++;
}
```

and memory is laid out like this:

<i>q</i>	1000	<input type="text"/>
<i>p</i>	1004	<input type="text"/>
<i>b</i>	1008	<input type="text"/>
<i>a</i>	1012	<input type="text"/>

what do you see if you print:

(1 point)

(a) a

(a) _____

(1 point)

(b) &a

(b) _____

(1 point)

(c) b

(c) _____

(1 point)

(d) &b

(d) _____

(1 point)

(e) p

(e) _____

(1 point)

(f) *p

(f) _____

(1 point)

(g) &p

(g) _____

(1 point)

(h) q

(h) _____

(1 point)

(i) *q

(i) _____

(1 point)

(j) &q

(j) _____

- (12 points) 11. Write a function which is passed an `int A[]` of positive integers and `A`'s length. The function reverses `A`. For example, if before the function, `A[]` is `{10,20,30,40,50}`, after the function, `A[]` is `{50,40,30,20,10}`. Do not use the `[]` operator in the body of the function.

- (10 points) 12. Recall that a byte is 8 bits. A nibble is 4 bits. Write a function which is passed an `int x`. The function prints each of the nibbles of `x` (represented in hex), one nibble per line. (In case you forgot, the `printf` format specifier for hex is `%x`.)

- (10 points) 13. Write a function whose sole argument is a C string. The function returns the address of the letter in the string which would appear last in the alphabet. You may use any function in `<ctype.h>`, but do not use any functions in `<string.h>`.

- (12 points) 14. Write a program that takes at the command line a list of one or more files. The program prints each file to the screen with all vowels `{a,e,i,o,u}` removed. For example, if one file contains “Is this test long?”, the program would print “s ths tst lng?”.

(extra space)