CprE 185: Intro to Problem Solving (using C)
Midterm 1: Wednesday Sep 22, 2010

Student Name:
Student ID Number:
Lab Section (circle one): Tue 10-12, Tue 12-2, Tue 2-4, Tue 4-6, Wed 12-2

1. True/False Questions (10 x 1p each = 10p)

(a) The Java language was named after Java the Hutt from Star Wars TRUE / FALSE

(b) In any C file the main function must be declared last TRUE / FALSE

(c) The system function is defined in stdlib.h TRUE / FALSE

(d) The printf function always returns a value TRUE / FALSE

(e) The Unicode datatype in C is called uchar TRUE / FALSE

(f) The linker runs after the compiler TRUE / FALSE

(g) A C function can call itself TRUE / FALSE

(h) Most runtime errors are caused by typos in the source file TRUE / FALSE

(i) A 2-digit decimal is always larger than a 1-digit hexadecimal number TRUE / FALSE

(j) In C the only datatype that is waterproof is the float TRUE / FALSE

2. Floating Point Numbers (2 x 2.5p each = 5p)

(a) Convert the following 32-bit float number (in IEEE 754 standard) to decimal

```
1  1 0 0 0 0 0 0 0   1 0 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
```

(b) Convert $3F400000_{16}$ (a 32-bit float stored in IEEE 754 format) to decimal:

3. **Short answers (5 x 2p each = 10p)**

(a) Who was Little Endian?

(b) What is a function argument?

(c) What is the difference between `#define PI 3.14` and `M_PI` ?

(d) What is an integer?

(e) What is a front side bus?

4. Debugging (10 pt)
Find all bugs in the following program. Draw a circle around each bug and write a short message similar to the ones given by the compiler about the problem.

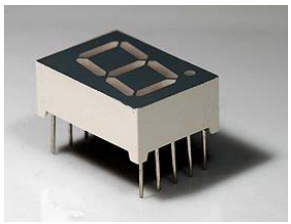
```
#include <stdio.h>
#include <stdlip.h


doable calculate()
{
    int  result=42;
    return result;;
};


int Main()
{
    print("Hello World!/n’):

    int res = calculate(7);

    system('Pause"),
]
```

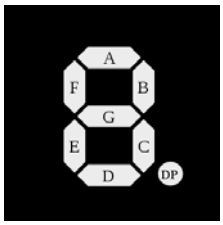
5. What is the Output? (5 pt)
Write down what would be printed by the following program segment.

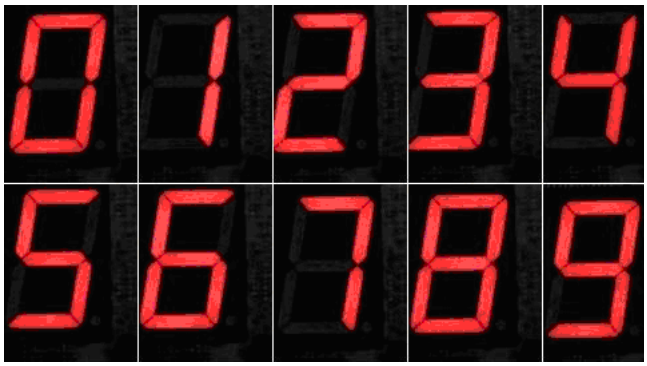
```
int d=65;
printf("[\\%%3d//\b%%%c]\n", d);
```

6. Seven-Segment Indicators (10 pt)

Many electronic devices use seven-segment indicators to display numbers. Examples of such devices include: microwave ovens, alarm clocks, and even the odometers in modern cars. Each of the seven segments is typically implemented with a light emitting diode (LED). By selectively turning the segments on/off one can display all digits (0-9) and even some letters.

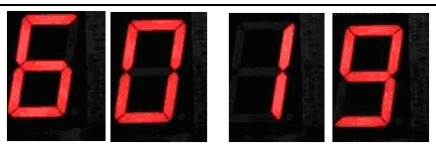






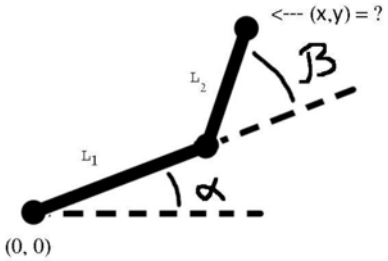
The seven segments are labeled from A to G as shown in the figure above. One popular standard for controlling them requires the programmer to specify a binary number in the form ABCDEFG, where a value of 1 for any of the bits indicates that the corresponding segment will be turned on, while a value of 0 means that the segment will be turned off. Sometimes, however, it is more convenient to convert the binary number into a hexadecimal number. If multiple digits have to be displayed at once then multiple indicators (and numbers) are used.

Your task in this problem is to write down the binary and the hexadecimal representations for each of the following:

Seven-Segment Number	**Binary Representation**	**Hexadecimal Representation**
		
		
		
		

7. Forward Kinematics (15 p)

Write a complete C program that asks the user to enter two joint angles for a very simple two-joint robot. The program must first convert these angles from degrees to radians by calling a function and then use them to calculate and print the x and y coordinates of the tip of the robot's second link inside the main function. The lengths of the two links are constants: L1 = 0.5 and L2 = 0.3. Hint: The formulas for x and y are as follows:



$$x = L_1 cos(\alpha) + L_2 cos(\alpha + \beta)$$
$$y = L_1 sin(\alpha) + L_2 sin(\alpha + \beta)$$

Question	Max	Score
True/False	10	
Floating point numbers	5	
Short answers	10	
Debugging	10	
What is the output	5	
7-segment indicators	10	
Forward Kinematics	15	
Program 1 (lab)	10	
Program 2 (lab)	15	
Program 3 (lab)	15	
Program 4 (lab)	15	
Program 5 (lab)	15	
TOTAL:	135	

May the source be with you!