CprE 288 Spring 2016 – Homework 2
Due Sun January 31 (11:59pm on Blackboard)

Notes:
- Homework is individual work. Adhere to the University’s policy relating to the integrity of scholarship. See [http://catalog.iastate.edu/academiclife/regulations/](http://catalog.iastate.edu/academiclife/regulations/), “Academic Dishonesty”.
- Homework must be typed and uploaded to BlackBoard as a PDF or Word Document (i.e. .doc or .docx) only.
- Late homework is accepted within three days from the due date. Late penalty is 10% per day (for each 24 hours following your class).

Note: Unless otherwise specified, all problems assume the ATMega128 is being used

Question 1 (10 pts): Variable Names

Indicate if each is a valid (Yes), or not valid (No) variable name

a. NO while
b. YES _while
c. NO 2yearnum
d. YES yellow
e. YES mylist
f. YES ELSE
g. NO else
h. NO CPRE$288
i. YES CPRE_288
j. YES _cpre288
Question 2 (10 pts): Memory Allocation (Reminder assume an ATMega128 is the target hardware unless otherwise specified)

a. For each declaration indicate how many bytes will be allocated in memory (5 pts)
   i) \texttt{2} int apple;
   ii) \texttt{400} long my_oranges[100];
   iii) \texttt{400} signed float sensor_readings[100];
   iv) \texttt{280} unsigned short class_grades[140];
   v) \texttt{2000} unsigned int scan_data[10][100];

b. For each indicate the value of \texttt{my\_length} after executing each fragment of C code. Function \texttt{strlen} is a standard C library function. Specify N/A if the value of \texttt{my\_length} cannot be determined. (5 pts)
   i) \texttt{my\_length} is \texttt{7}.
      \begin{verbatim}
      char msg[] = "CPRE288";
      int my_length = 0xFFFF;
      my_length = strlen(msg);
      \end{verbatim}
   ii) \texttt{my\_length} is \texttt{7}.
      \begin{verbatim}
      char msg[20] = "CPRE288";
      int my_length = 0xFFFF;
      my_length = strlen(msg);
      \end{verbatim}
   iii) \texttt{my\_length} is \texttt{4}.
      \begin{verbatim}
      char msg[100] = {'C','P','R','E','\0','2','8','8',\0};
      int my_length = 0xFFFF;
      my_length = strlen(msg);
      \end{verbatim}
iv) my_length is ___7_____.

    char msg[] = "iRobot CPRE288";
    int my_length = 0xFFFF;
    my_length = strlen(msg + 7);

v) my_length is ___0______.

    char msg[] = "CPRE288";
    int my_length = 0xFFFF;
    my_length = strlen(msg + strlen(msg));

**Question 3 (10 pts): Memory Map**

a) Fill in the given memory map after the C fragment below has been executed. Note: The ATMega128 uses Little Endian ordering for memory (i.e. lower significant bytes of an element are stored at lower addresses) (7 pts)

    int age[2] = {0x18, 0x20};
    char msg[5] = "5288";
    long speed[1] = {0x21474D13};

    age[4] = 0x4F20;
    msg[9] = 0;
    printf("%s", msg+1);

<table>
<thead>
<tr>
<th>Memory Location</th>
<th>0xFF00</th>
<th>0xFF01</th>
<th>0xFF02</th>
<th>0xFF03</th>
<th>0xFF04</th>
<th>0xFF05</th>
<th>0xFF06</th>
<th>0xFF07</th>
<th>0xFF08</th>
<th>0xFF09</th>
<th>0xFF0A</th>
<th>0xFF0B</th>
<th>0xFF0C</th>
<th>0xFF0D</th>
</tr>
</thead>
<tbody>
<tr>
<td>Value</td>
<td>0x18</td>
<td>0x00</td>
<td>0x20</td>
<td>0x35</td>
<td>0x32</td>
<td>0x38</td>
<td>0x38</td>
<td>0x20</td>
<td>0x4F</td>
<td>0x47</td>
<td>0x21</td>
<td>0x00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Array</td>
<td>age</td>
<td>msg</td>
<td>speed</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Index</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0</td>
</tr>
</tbody>
</table>

b) What message will `printf` print for part a) (3 pts)

288 OMG!
Question 4 (10 pts): C-string formatting

Given:

```c
char message[100];
char str1[] = “CprE”;
char str2[] = “iRobot”;
int num = 100;
char ch1 = 50;
char ch2 = 56;
```

Predict the C-string contained in `message` after each `sprintf` (2 pts each)

**Note 1:** Treat each part independently
**Note 2:** You may need to look up on your own more details on `printf` and `sprintf`

a) `sprintf(message, “Our %s is moving”, str2);`
   *Our iRobot is moving*

b) `sprintf(message, “Read %d datasheet pages every week”, num);`
   *Read 100 datasheet pages every week*

c) `sprintf(message, “CprE%c%c%c is %s!”, ch1, ch2, ch2, “fun”);`
   *CprE288 is fun!*

d) `sprintf(message, “Move the %s forward for %d cm”, str2+3, num/2);`
   *Move the bot forward for 50 cm*

e) `sprintf(message, ”The ASCII value for %c is decimal %d and hex %X”,
   ch1+ch2, (int)(ch1+ch2), (int)(ch1+ch2));`
   *The ASCII value for j is decimal 106 and hex 6A*
Question 5 (10 pts)
Follow the gcc/Linux tutorial given for HW2 to see how to write a C program in a text editor, and compile and run your program on the Linux operating system.

Your program should print the following:

Hello, my name is FIRST LAST!

Where FIRST and LAST should be your first and last name. The graders will check this against the name on your homework.

Provide the following screen shots

a) A screen shot of your completed source code within a Linux text editor (5pts)

```c
#include<stdio.h>

void main()
{
    char Name[8]="Pei Zhang";
    printf("Hello, my name is %s\n",Name);
}
```

b) A screen shot that shows i) the gcc command to compile your program, ii) the command to run your program, iii) the output of your program. (5pts)

```
bash-4.1$ gcc -o test1 test.c
bash-4.1$ ./test1
Hello, my name is PeiZhang!
bash-4.1$ gcc -o test1 test.c
bash-4.1$ ./test1
Hello, my name is Pei Zhang!
bash-4.1$ 
```