1. For a particular 10-bit analog to digital converter with a reference voltage of \( v^+ = 3.3 \) volts and \( v^- = 0 \) volts
   a. determine the input voltage if the digital representation is 01 0000 0010. (10 points)
   b. determine the digital representation of the input voltage 1.7 volts. (10 points)

2. Write the C code for the MSP430 Launchpad Board to, forever, read the digital input on pins 7 to 0 of Port 1 as a binary value and output on pins 2 to 0 of Port 2 as a simple encoded value, according to the table at the right. Write the FULL code listing needed (we have already helped with identifying include files, disabling the watchdog timer). This is so simple, there is no need for interrupts. You do not need to write comments or a block headers for this question. (30 points)

```c
#include <msp430.h>

// main - do all of the work in the exercise - decode input
// Input:  Port 1, bits 7:0
// Output: Port 2, bits 2:0
int main(void) {
    WDTCTL = WDTPW | WDTHOLD; // Stop watchdog timer
    return 0;
}
```

<table>
<thead>
<tr>
<th>Input  (bits 7:0)</th>
<th>Output (bits 2:0)</th>
</tr>
</thead>
<tbody>
<tr>
<td>00000001</td>
<td>000</td>
</tr>
<tr>
<td>00000010</td>
<td>001</td>
</tr>
<tr>
<td>00000100</td>
<td>010</td>
</tr>
<tr>
<td>00001000</td>
<td>011</td>
</tr>
<tr>
<td>00010000</td>
<td>100</td>
</tr>
<tr>
<td>00100000</td>
<td>101</td>
</tr>
<tr>
<td>01000000</td>
<td>110</td>
</tr>
<tr>
<td>10000000</td>
<td>111</td>
</tr>
</tbody>
</table>
3. Consider the code segment below:

```c
#include <stdio.h>
#include <stdlib.h>
#define NUM 15
int global1;
int global2 = 3;
char str1 = "sometext";
int main()
{
    int num1 = 1;
    int num2;
    char *str2;
    str2 = (char *) malloc(NUM);
    strcpy(str2, str1);
    printf("String = %s\n", str2);
    while(1);

    return(0);
}
```

In the memory map, fill in the appropriate section where the variables and macros might belong. There can be multiple answers for each section. (25 points)

4. You are working on a project where you need to update software that someone else wrote. The code below is written for an unknown processor, but has no comments. Write the comments for each line (what does each line do?). Just write comments on your answer sheet - do no rewrite the code. (25 points)

```c
1. while(1){
2.     if(S12AD.ADCSR.BIT.ADCSTART == 0){
3.         ADC_data = S12AD.ADDR0 & 0X0FFF;
4.         sprintf(ADC_OUT,"%d",ADC_data);
5.         lcd_display(LCD_LINE2,ADC_OUT );
6.         S12AD.ADCSR.BIT.ADCSTART = 1;
7.     }
8. }
```