1. (8 points)
Write the output for the following program. Assume input is aBcD!0
Use this scale below if it is useful to you.

<table>
<thead>
<tr>
<th>0</th>
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</thead>
<tbody>
<tr>
<td>A</td>
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<td>C</td>
<td>D</td>
<td>E</td>
<td>F</td>
<td>G</td>
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<td>P</td>
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<td>V</td>
<td>W</td>
<td>X</td>
<td>Y</td>
<td>Z</td>
</tr>
</tbody>
</table>

WRITE YOUR OUTPUT HERE

Out Line 1

Out Line 2

#include <stdio.h>
#include <ctype.h>
int main() {
    char c;
    while (((c = getchar()) != 'O') {
        if (isupper(c))
            putchar(('A' + 15-(c-'A')));
        else if (islower(c))
            putchar(('a' + 5+(c-'a')));
        else
            putchar(c);
    }
    return 0;
}
2. (15 points) Write down what the printed output of this program is:

```c
#include <stdio.h>
int f1(int *a, int b);
int f2(int a, int *b);
int main(void) {
    int a=5, b=2, c=7, d=9;
    c = f1(&d, a);
    printf("a=%d b=%d c=%d d=%d\n",a,b,c,d);
    a = f2(c-d, &a);
    printf("a=%d b=%d c=%d d=%d\n",a,b,c,d);
    b = f1(&c, 8);
    printf("a=%d b=%d c=%d d=%d\n",a,b,c,d);
    d = f2(b, &a);
    printf("a=%d b=%d c=%d d=%d\n",a,b,c,d);
    return 0;
}
int f1(int *a, int b) {
    *a = b -8;
    b = b*2 - (*a);
    printf("In f1: a=%d b=%d\n", *a, b);
    return b - *a;
}
int f2(int a, int *b) {
    a = *b-a;
    *b = 37 - *b;
    printf("In f2: a=%d b=%d\n", a, *b);
    return a;
}

Answers q1:
f0hM!
```
3. (10 points)
Write down what the printed output of this program is:

```
#include <stdio.h>
int f(int c, int b, int a);

int main() {
    int a = 2, b = 3, c=5;
    printf("a=%d b=%d c=%d\n", a, b, c);
    a = f(b, a, b+c);
    printf("a=%d b=%d c=%d\n", a, b, c);
    return 0;
}

int f(int c, int b, int a) {
    int sum;
    sum = a + b + c;
    if (sum > a*c)
        return a*c;
    if (sum <= b*c)
        return b*c;
    return a*b;
}
```

---

WRITE YOUR OUTPUT HERE

Out Line 1

Out Line 2
4. (12 points) Write down what the printed output of this program is:

```c
#include <stdio.h>
int f1(int *a, int c);
int main(void) {
    int a=2, b=3, c=4, d=5;
    a = f1(&c, b);
    printf("a= %d b= %d c= %d d= %d\n",a,b,c,d);
    return 0;
}
int f1(int *a, int c) {
    *a = c - 2;
    c = c*2 - (*a);
    printf("a= %d c= %d\n", *a, c);
    return c - *a;
}
```

THIS OUTPUT WILL BE GRADED

Out Line 1

Out Line 2

Out Line 3
5. (14 points) Write down what the printed output of this program is:

```c
#include <stdio.h>
int f1(int *a, int c);
int main(void) {
    int a=2, b=3, c=4, d=5;
    a = f1(&c, f(&b,d));
    printf("a= %d b= %d c= %d d= %d\n",a,b,c,d);
    return 0;
}
int f1(int *a, int c) {
    *a = c - 2;
    c = c*2 - (*a);
    printf("a= %d c= %d\n", *a, c);
    return c - *a;
}
```

---

OUT LINE 1
OUT LINE 2
OUT LINE 3
6. (11 points)
Write down what the printed output of this program is:

```c
#include <stdio.h>

int f(int c, int b, int a);

int main() {
    int a = 1, b = 2, c=2;
    a = f(b, f(a, c, b+c), a+c);
    printf("a=%d b=%d c=%d\n", a, b, c);
    return 0;
}

int f(int c, int b, int a) {
    int sum;
    b = a + c;
    sum = a + b + c;
    printf("a=%d b=%d c=%d\n", a, b, c);
    if (sum > a*c)
        return a*c;
    if (sum <= b*c)
        return b*c;
    return a*b;
}
```

Out Line 1
Out Line 2
Out Line 3
7. (15 points)
Write down what the printed output of this program is:

```c
#include <stdio.h>
int f(int *a, int c, int b);
int main(void) {
    int a=1, b=3, c=2;
    a = f(&c, f(&b,a,c),a);
    printf("a= %d b= %d c= %d\n",a,b,c);
    return 0;
}

int f(int *a, int c, int b) {
    *a = *a - 1;
    c = c*2 + (*a);
    b = b - 1;
    printf("a= %d b= %d, c= %d\n", *a, b, c);
    return c - *a + 1;
}
```

ONLY THIS OUTPUT WILL BE GRADED

Out Line 1

Out Line 2

Out Line 3
8. (14 points) Write down what the printed output of this program is:

```c
#include <stdio.h>
#include <ctype.h>
int main() {
    char first[30], last[30];
    char wholename[60];
    scanf("%s", first);
    scanf("%s", last);
    if (strcmp(first, last) < 0)
        printf("Your first name comes first alphabetically.\n");
    else if (strcmp(first, last) == 0)
        printf("You’re weird.\n");
    else
        printf("Your last name comes first alphabetically.\n");
    printf("first = %s, last = %s\n", first, last);
    strcat(first, last);
    printf("first = %s, last = %s\n", first, last);
    strcpy(wholename, first);
    printf("first = %s, wholename = %s\n", first, wholename);
    printf("Your whole name is %d characters.\n", strlen(wholename));
    return 0;
}
```

<table>
<thead>
<tr>
<th>Out Line 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Out Line 2</td>
</tr>
<tr>
<td>Out Line 3</td>
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<tr>
<td>Out Line 4</td>
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<tr>
<td>Out Line 5</td>
</tr>
</tbody>
</table>

THIS OUTPUT WILL BE GRADED

8
9. (15 points) Suppose the main function is written in a manner with which we are already familiar, what are the values written out by writeoutpic? The values of numRows and numCols are each 3. Assume that all the global declarations and definitions are as in your Assignment 4. The picture being read in has the values:

```
3 4 2
1 3 2
8 4 2
```

```
--- WRITE YOUR OUTPUT HERE ---
```

```c
int main()
{
    char fileName[BUFFER_SIZE];
    int i, j, rows, cols;
    char ci;
    printf("Enter image filename: ");
    scanf("%s", fileName);
    img = readpic(fileName);
    printf("Successfully read image file \"%s\"\n", fileName);
    changepixels(img);
    printf("Enter image filename for output: ");
    scanf("%s", fileName);
    writeoutpic(fileName, img);
    free(img);
    img = NULL;
    return(EXIT_SUCCESS);
}

void changepixels(int ** imgtemp)
{
    int i, j;
    for (i=0; i<numRows; i++)
    {
        for (j=0; j<numCols; j++)
        {
            imgtemp[i][j] += (i - j);
        }
    }
}
```
10. (10 points) Suppose all is as in question above. what are the values written out by writeoutpic, if changepixels is defined as:

```c
void changepixels(int** imgtemp)
{
    int i,j;
    for (i=0;i<numRows;i++)
        imgtemp[i][ numCols/2 ] = 255;
    for (j=0;j<numCols;j++)
        imgtemp[ numRows/2 ][j] = 255;
}
```
11. (10 points) Suppose all is as in question above. what are the values written out by writeout pic, if changepixels is defined as:

```c
void changepixels(int** imgtemp)
{
    int i, j;
    for (i=0; i<numRows; i++)
        for (j=0; j<(numCols/2); j++)
            pic [i][numCols/2 + j] = pic [i][j];
}
```
12. (10 points) Suppose all is as in question above. what are the values written out by writeout pic, if changepixels is defined as:

```c
void changepixels(int** imgtemp)
{
    int i,j;
    for (i=0;i<numRows;i++)
    {
        for (j=0;j<(numCols/2);j++)
        {
            pic [i][numCols/2 + j] = pic [j][i];
        }
    }
}
```
13. (10 points) Suppose all is as in question above. What are the values written out by writeout pic, if changepixels is defined as:

```c
void changepixels(int** imgtemp)
{
    int i,j;
    for (i=numRows-1;i>0;i--)
    { for (j=0;j<numCols;j++)
        {
            imgtemp[i - numCols/2][j] = imgtemp[i][numCols - j - 1];
        }
    }
}
```

14. (5 points)
Write the output for the following program. Assume input is Eb*C9 Use this scale below if it is useful to you.

```
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25
```

```c
#include <stdio.h>
#include <cctype.h>
int main()
{
    char c;
    while ( ((c = getchar()) != '9') )
    {
        if (isupper(c))
            putchar((c + 5 - (c - 'A')));
        else if (islower(c))
```
putchar(('P' + 1 + (c-'a')));
else
    putchar(c);
}
return 0;
}
15. (12 points)
Write down what the printed output of this program is:

```
#include <stdio.h>
int f(int a, int d, int b, int c);
int main() {
    int a = 1, b = 3, c=2, d=4;
    a = f(d, a, f(a, c, b+c, d), a+c);
    printf("a=%d b=%d c=%d d=%d\n", a, b, c, d);
    return 0;
}
int f(int a, int d, int b, int c) {
    int sum;
    b = a + c;
    sum = b - c;
    d = sum + d;
    printf("a=%d b=%d c=%d d=%d\n", a, b, c, d);
    if (sum > a*c)
        return a*c;
    if (sum <= b*c)
        return sum+a;
    return a*b;
}
```

ONLY THIS OUTPUT WILL BE GRADED

Out Line 1
Out Line 2
Out Line 3
16. (16 points)
Write down what the printed output of this program is:

```c
#include <stdio.h>
int f(int *d, int c, int b, int *a);
int main(void) {
    int a=1, b=3, c=2, d=4, e=5;
    e = f(&a, f(&b,a,e,&c),e,&d);
    printf("a= %d b= %d c= %d d= %d e= %d\n",a,b,c,d,e);
    return 0;
}

int f(int *d, int c, int b, int *a) {
    *a = *a + 1;
    c = c + (*a);
    b = b + c;
    *d = *a + 2;
    printf("a= %d b= %d c= %d d="%d\n", *a, b, c, *d);
    return *d - *a + 2;
}
```

ONLY THIS OUTPUT WILL BE GRADED

Out Line 1

Out Line 2

Out Line 3
17. (17 points)
Suppose the main function is written in a manner with which we are already familiar, what are the 9 values written out by the function writeoutpic? The global values of numRows and numCols are each 3. Assume that all the global declarations and definitions are as in your Assignment 4. (TRACE THIS VERY CAREFULLY!!) The input picture (which has 3 rows and 3 columns) being read in, has the values:

```
5 4 1
6 2 7
3 9 8
```

**ONLY THIS OUTPUT WILL BE GRADED**

```c
int main()
{
  char fileName[BUFFER_SIZE];
  int i, j, rows, cols;
  char ci;
  printf("Enter image filename: ");
  scanf("%s", fileName);
  img = readpic(fileName);
  printf("Successfully read image file '%s'
", fileName);
  changepixels(img);
  printf("Enter image filename for output: ");
  scanf("%s", fileName);
  writeoutpic(fileName, img);
  free(img);
  img = NULL;
  return(EXIT_SUCCESS);
}

void changepixels(int** imgtemp)
{
  int i, j;
  for (i=numRows-1; i>0; i--)
    ( for (j=0; j<numCols; j++)
      {
        imgtemp[i][numCols - j -1] = imgtemp[i - numCols/2][j];
      }
    }
}