1. (15 points) A student intends to write a program to convert temperature from Fahrenheit to Celsius, but is not sure how to implement the conversion equation

\[ ^\circ C = \frac{5(\circ F - 32)}{9} \]

He makes three different attempts to implement this equation, using the variables `celsius1`, `celsius2`, and `celsius3` to represent the temperature in degrees Celsius, and `fahr` for the temperature in degrees Fahrenheit. All three attempts are included in the program shown below:

```c
main()
{
    float celsius1, celsius2, celsius3, fahr = 68.0;

    celsius1 = 5 / 9 * (fahr - 32);
    celsius2 = 5 * (fahr - 32) / 9;
    celsius3 = (fahr - 32) * 5.0 / 9.0;
}
```

What values will be assigned to `celsius1`, `celsius2` and `celsius3` after the program is executed?

\[ celsius1 = \]

\[ celsius2 = \]

\[ celsius3 = \]
2. (20 points) This question pertains to the program shown below:

```c
#include <stdio.h>

main{
    char sex;
    int age;
    float bp, dose;

    printf("Please enter the sex of the patient (m/f): ");
    scanf(" %c", &sex);

    printf("Please enter the patient's age: ");
    scanf("%i", &age);

    printf("Please enter the patient's systolic ");
    printf("blood pressure: ");
    scanf("%f", &bp);

    if (sex == 'm')  {
        if (age < 50)  {
            if (bp < 140)  {
                dose = 440;
            }
            else  {
                dose = 520;
            }
        }
        else  {
            if (bp < 180)  {
                dose = 580;
            } else  {
                dose = 665;
            }
        }
    }
    else  {
        if (bp < 180)  {
            dose = 580;
        } else  {
            dose = 665;
        }
    }
    printf("The recommended dosage is %.1f milligrams", dose);
}
```
Circle the one correct answer to each of the following questions.

(a) Which of the following patients would be recommended a dosage of 580 milligrams?
   - Female, age 61, bp=182.2
   - Female, age 61, bp=145.0
   - Male, age 61, bp=182.2
   - Male, age 61, bp=145.0
   - Male, age 45, bp=182.2

(b) Which of the following patients would be recommended a dosage of 520 milligrams?
   - Female, age 61, bp=182.2
   - Female, age 61, bp=145.0
   - Male, age 61, bp=182.2
   - Male, age 61, bp=145.0
   - Male, age 45, bp=182.2

(c) What dosage would be recommended for a 32 year-old male patient with bp=128.0?
   - 440 milligrams
   - 465 milligrams
   - 520 milligrams
   - 580 milligrams
   - 665 milligrams

(d) What patients would be recommended a dosage of 465 milligrams?
   - All males
   - All females
   - All males over 50 years
   - All males with bp>180
   - None of the above
3. (25 points) A student wants to write a C program that will display the square roots of the integers 1 through NumMax, where NumMax is entered by the user. A portion of the program is shown below. Complete the program by writing the missing program statements. (Assume the student will always enter a positive integer.)

/* program to calculate square roots */

#include <stdio.h>
#include <math.h>

main()
{
    int count, NumMax;
    float root;

    /* begin your code here */

} /* end of program */
4. (25 points) A student is planning to write a program that will analyze a simple electrical circuit containing two resistors. The resistors may be connected either in series or in parallel. The purpose of the program is to determine the overall resistance (either the total resistance, when the resistors are connected in series, or the equivalent resistance, when the resistors are connected in parallel – see the formulas below). The program should prompt the user for the appropriate input data.

(a) What input data will be required by this program?

(b) What output data will be generated?

(c) On the next page, write a pseudocode outline (or a flowchart, if you prefer) that will guide the student in writing the final program. DO NOT WRITE THE ACTUAL C PROGRAM!

Note: For resistors $R_1$ and $R_2$ connected in series, $R_T = R_1 + R_2$

For resistors $R_1$ and $R_2$ connected in parallel, $R_{eq} = \frac{R_1R_2}{(R_1 + R_2)}$

Write your pseudocode outline or flowchart below:
5. (15 points) This question applies to the program shown on the next page. The lines have been numbered, for your convenience.

(a) When a student attempted to run this program, it compiled correctly but generated a “General Protection Exception” message when the user tried to enter the coefficients of the quadratic equation. Explain why (find the reason for the error message).

(b) When the student fixed the problem and reran the program, it compiled and executed successfully the first time. However, she was unable to repeat the execution. Explain why.

(c) If the two problems in (a) and (b) are corrected and the user wishes to solve the equation

\[ 5x^2 + 6x - 32 = 0, \]

which branch is executed (real, repeated or complex)?
/* roots of a quadratic equation */

#include <stdio.h>
#include <math.h>
#include <ctype.h>

main()
{
    float a, b, c, disc, u, v, x1, x2;
    char ans;

    do {
        /* read input data */
        printf("Roots of a Quadratic Equation\n\n");
        printf("Please enter values for a, b and c: ");
        scanf("%f %f %f", a, b, c);

        /* determine a value for the discriminant */
        disc = b*b - 4 * a * c;

        /* calculate and display the roots */
        if (disc > 0) { /* REAL ROOTS */
            x1 = (-b + sqrt(disc))/(2*a);
            x2 = (-b - sqrt(disc))/(2*a);
            printf("Real roots: x1 = %f   x2 = %f\n", x1, x2);
        }
        else if (disc == 0) { /* REPEATED ROOT */
            x1 = -b/(2*a);
            printf("Repeated root: x = %f\n", x1);
        }
        else { /* COMPLEX ROOTS */
            u = -b/(2*a);
            v = sqrt(-disc);
            printf("Complex roots: x1 = %f + %fi\n", u, v);
            printf("               x2 = %f - %fi\n", u, v);
        }
    } while (toupper(ans) == 'Y'); /* end outer loop */

    printf("\nAgain? (Y/N) ");
    scanf(" %c", &ans);
    printf("Bye, have a nice day!");
}