



- I. We wish to write a C program to find the roots of a quadratic equation. Without using any function from the "math.h" C library, write the following:
- 1- A C function that takes as a parameter a real number and returns its absolute value,
 - 2- A C function that takes two parameters, a real number X, and an integer Y, and returns X^Y ,
 - 3- A C function that takes as a parameter a real number and returns its square root by using the following formula :

$$U_n = \frac{1}{2} \left(\frac{A}{U_{n-1}} + U_{n-1} \right)$$

where $U_0=1$ and A is the real number,
when $|U_n - U_{n-1}| \leq 10^{-5}$, U_n is the square root of A.

- 4- A function int QUAD (float, float, float, float *, float *), that takes as parameters three real numbers representing the coefficients a, b, and c of a quadratic equation, and returns the number of its roots (0 : no roots, 1 : double root, 2 : two distinct roots), the values of the roots will be placed in the last two parameters.
- 5- The C program that reads from the user the coefficients of a quadratic equation and displays the number of its roots and their values when they exist.

(35 pts = 5+5+5+10+10)

- II. We suppose that a moment of time is defined by:

- Hour an integer value
- Minute an integer value
- Second an integer value

1. Write the proposed data structure for a moment of time,
2. Write a C function DIFF_TIME that takes two parameters, a moment of time each, and returns the difference between them in seconds.

(15 pts = 5 + 10)

- III. Before launching a new product in the market, and to know how to market it, it is submitted to several assessments by several groups each consisting of several individuals.

We suppose in our case the existence of six groups, each formed of 5 individuals to evaluate four new products.

Each assessment consists of the following information:

- Group Number: positive integer between 1 and 6
- Individual Number: positive integer between 1 and 5
- Product Number: positive integer between 1 and 4
- 3 Grades (Necessity, Packaging, Acceptable price): 3 values each over 10
- Total: value over 10

- 1- Describe the proposed data structure for an assessment,
- 2- Write a function READ that receives the address of an assessment containing the group number, the individual number, and the product number, and reads from the user the three grades assigned by this individual and calculates the grades total,
- 3- Write a function FILL that uses the function READ to fill an array of assessments,
- 4- Write a function CALCULATE GROUP that takes as parameters an array of assessments, and the number of a group to calculate the sum of grades assigned by this group to each product. The results will then be placed in an array similar to that of assessments using only suitable members,
- 5- Write a function CALCULATE PRODUCT, that takes an array produced by CALCULATE GROUP, and produces a new array containing the final grades of each product,
- 6- Write the C program that treats the given assessments and displays the products in decreasing order of final grades.

(50 pts=5+10+5+10+10+10)