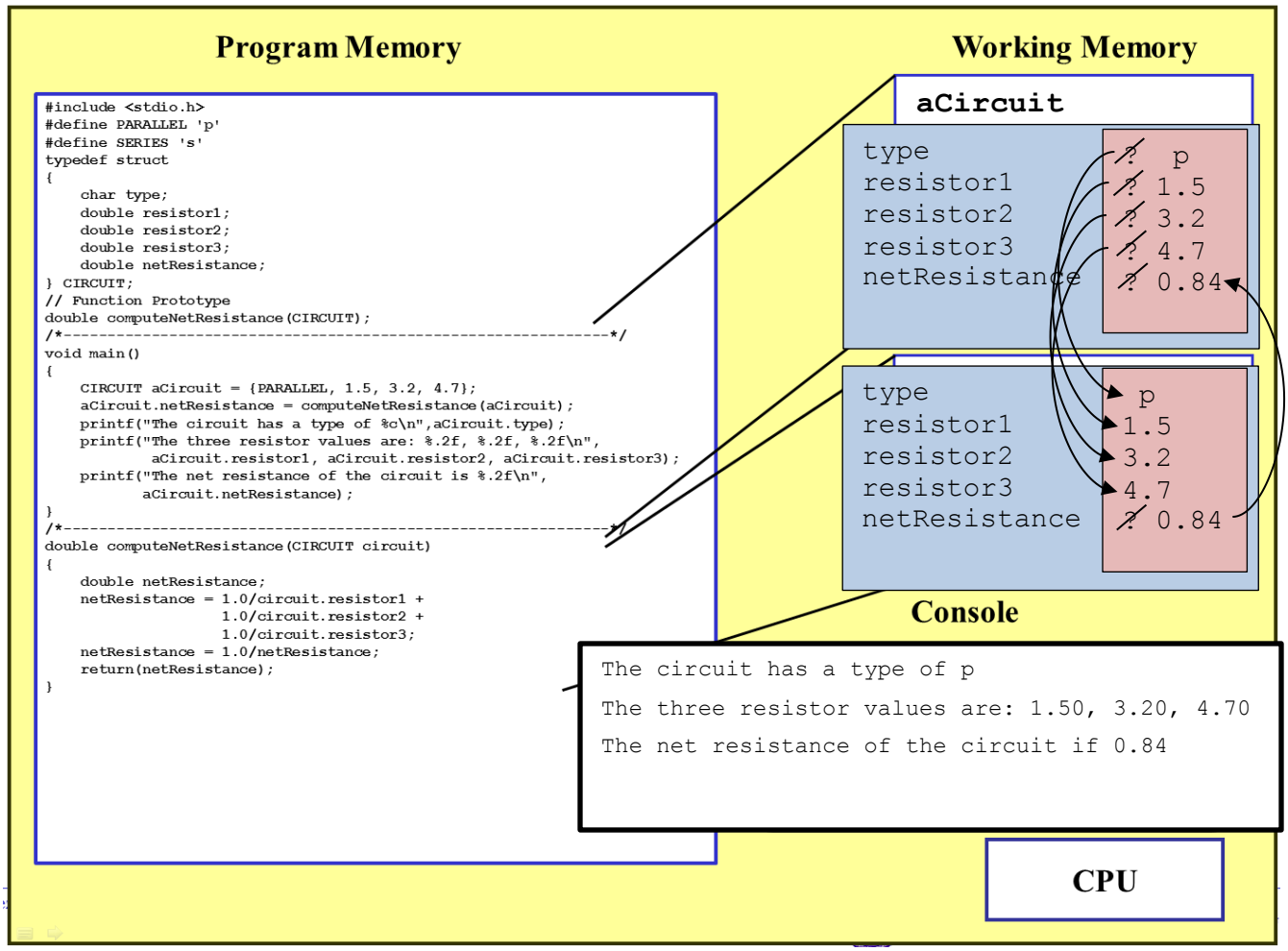
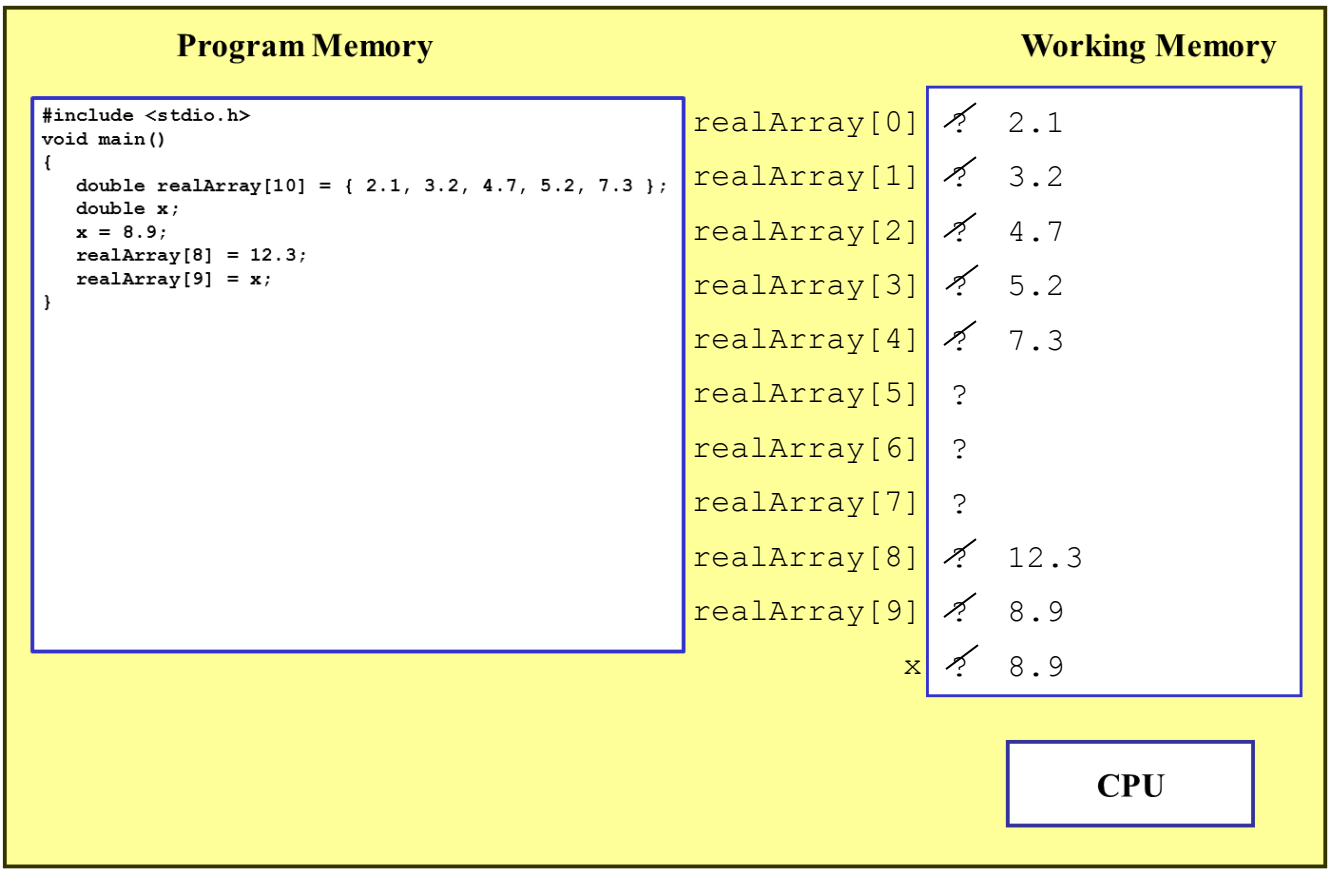
GNG1106 Fall 2016 - Assignment 3

Question 1

a)



b)


Program Memory
Working Memory
#include <stdio.h>
void main()
{
double realArray[10] = { 2.1, 3.2, 4.7, 5.2, 7.3 };
double x;
x = 8.9;
realArray[8] = 12.3;
realArray[9] = x;
}
realArray[0] ? 2.1
realArray[1] ? 3.2
realArray[2] ? 4.7
realArray[3] ? 5.2
realArray[4] ? 7.3
realArray[5] ?
realArray[6] ?
realArray[7] ?
realArray[8] ? 12.3
realArray[9] ? 8.9
x ? 8.9
CPU

Question 2 (15 marks)

1) Source code to the program :

Here is the source code to the program (the comments will be coloured in green, and the actual code in red to make it easier to read):

```
/*-------------------------------------------------------------------
File: RiseInTemperature.c
Author: Mohamed Bachrouch, 8160410
Description: A program that computes the rise in temperature in the
room after a given time t.
-------------------------------------------------------------------*/
#include <stdio.h>
#include <stdlib.h>
#include <math.h>
#define Cv 0.718
#define M 28.97
#define R 8.314
#define rate 0.08
#define student_volume 0.075
#define P 101.325

// We use a structure to group the characteristics of the room.
typedef struct
 {
     double height;
     double width;
     double length;
     int student_number;
     double initial_temp;
     double time;
 } ROOM;

// Function prototype
double RiseInTemperature(ROOM);

/*-------------------------------------------------------------------
Function: main
Description: Gets input values from user, calls function to compute
rise in temperature and displays results to the user. Displays values
provided by user and final temperature in output message.
-------------------------------------------------------------------*/
void main()
{
double final_temp;

// Variable declaration. aRoom is a variable of type ROOM.
ROOM aRoom;
```

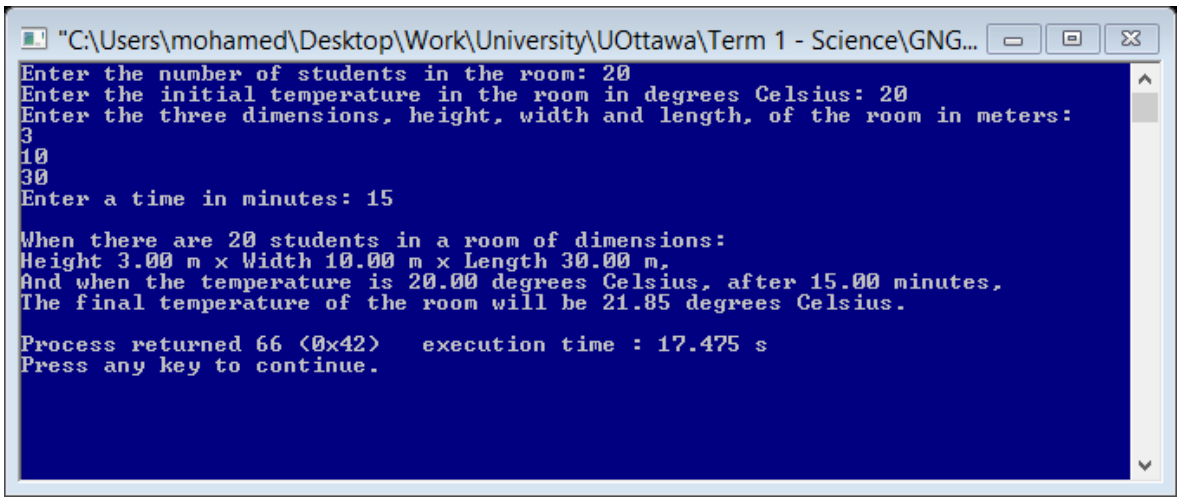
```
// Prompts the user
printf("Enter the number of students in the room: ");
scanf("%d",&aRoom.student_number);

printf("Enter the initial temperature in the room in degrees Celsius: ");
scanf("%lf",&aRoom.initial_temp);

printf("Enter the three dimensions, height, width and length, of the room
in meters: \n");
scanf("%lf %lf %lf",&aRoom.height,&aRoom.width,&aRoom.length);

printf("Enter a time in minutes: ");
scanf("%lf",&aRoom.time);

// Calling the function to compute the final temperature
final_temp=RiseInTemperature(aRoom);

// Display of results
printf("\nWhen there are %0.2d students in a room of
dimensions:\n",aRoom.student_number);
printf("Height %0.2f m x Width %0.2f m x Length %0.2f
m,\n",aRoom.height,aRoom.width,aRoom.length);
printf("And when the temperature is %0.2f degrees Celsius, after %0.2f
minutes,",aRoom.initial_temp,aRoom.time);
printf("\nThe final temperature of the room will be %0.2f degrees
Celsius.\n",final_temp);
}

/*--------------------------------------------------------------------
Function: RiseInTemperature
Parameters:
    all the members of the structure ROOM.
Return:  The final temperature final_temp.
Description: Computes the rise in temperature using the members of
the structure ROOM.

--------------------------------------------------------------------*/
double RiseInTemperature(ROOM aRoom)
{
    // Variable declaration
double final_temp;

// We convert the initial temperature from Celsius to Kelvin and the
// time from minutes to seconds
aRoom.initial_temp=aRoom.initial_temp+273.15;
aRoom.time=aRoom.time*60.0;

// instructions
final_temp=aRoom.height*aRoom.length*aRoom.width;
final_temp=final_temp-aRoom.student_number*student_volume;
final_temp=final_temp*P*Cv*M;
```

```
final_temp=(R*aRoom.initial_temp*aRoom.student_number*rate*aRoom.time)/fina
l_temp;
final_temp=final_temp+aRoom.initial_temp;

// We convert the temperature back to Celsius
final_temp=final_temp-273.15;

// The function returns the final temperature in Celsius
return(final_temp);
}
```

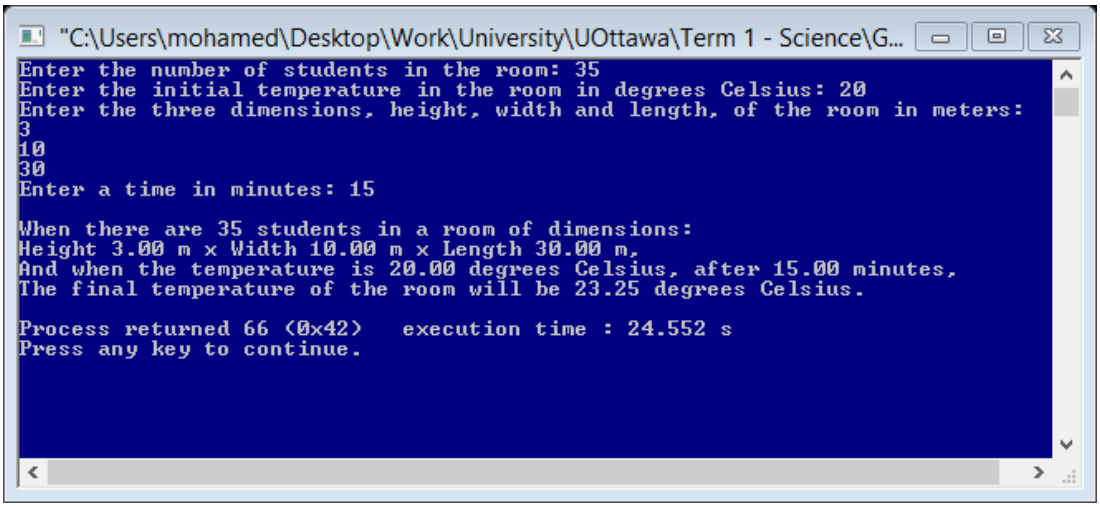
Test cases are on the next page.

2) The output for each test case:

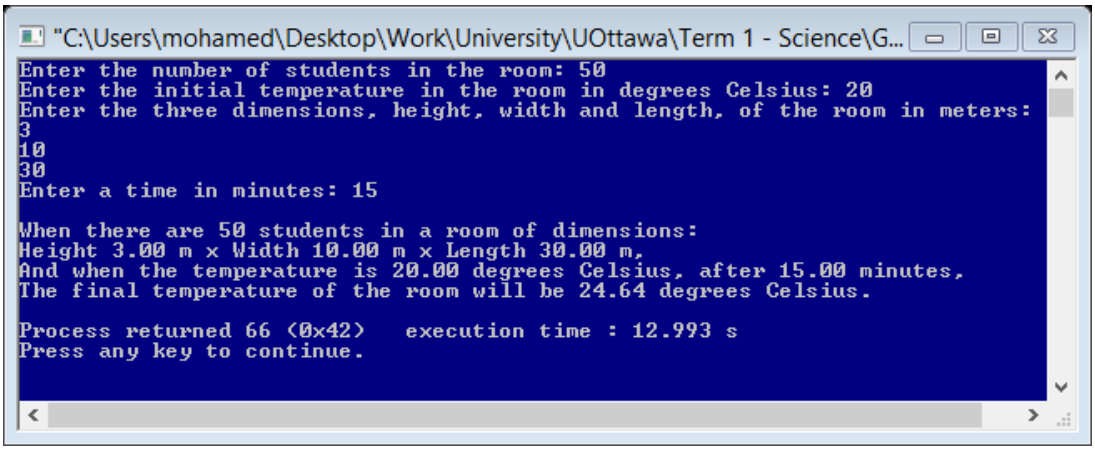
1-



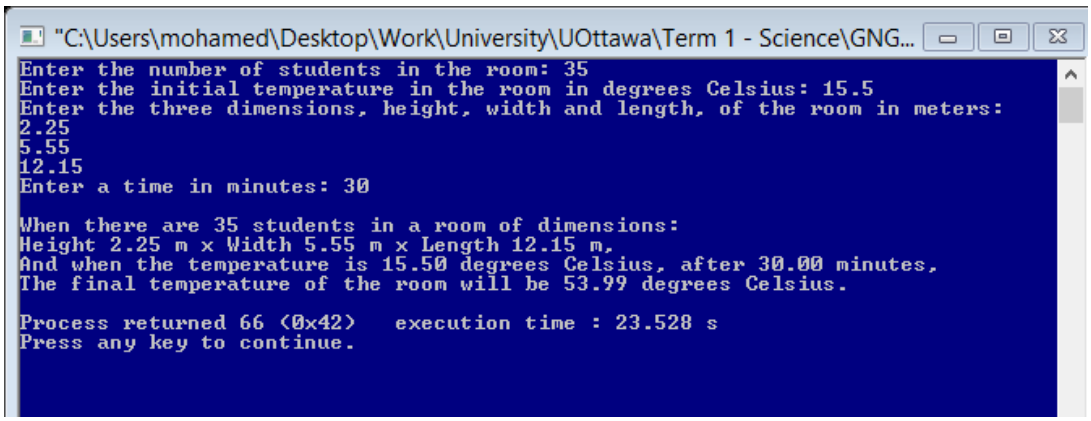
2-



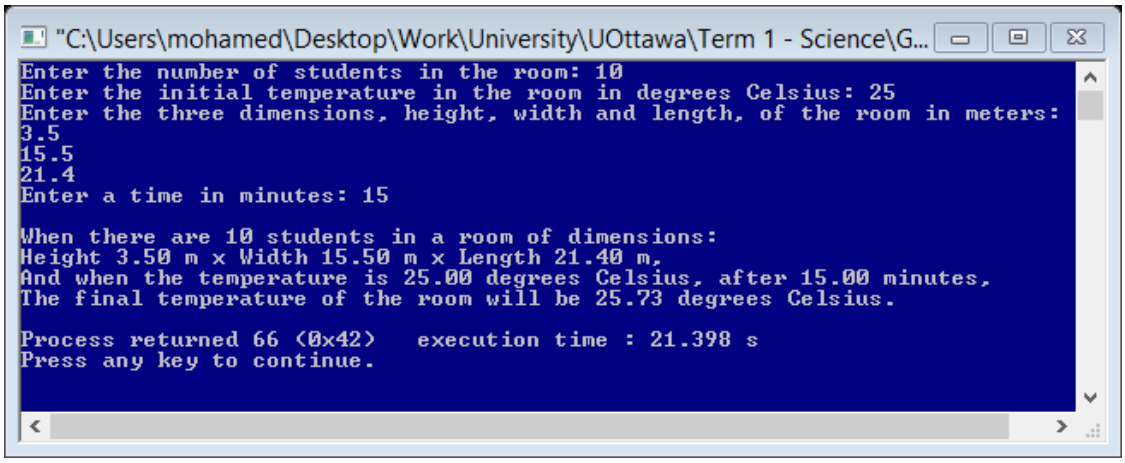
3-



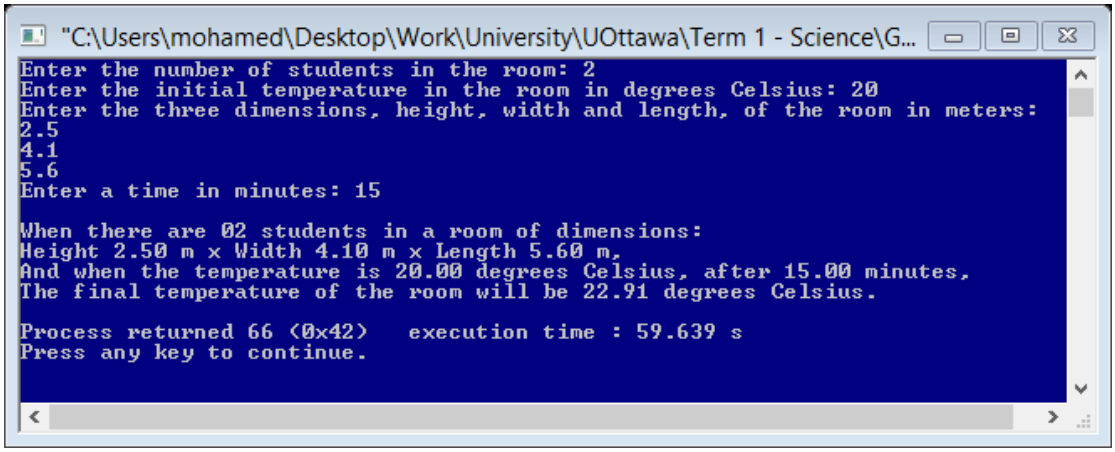
4-


"C:\Users\mohamed\Desktop\Work\University\UOttawa\Term 1 - Science\GNG...
Enter the number of students in the room: 35
Enter the initial temperature in the room in degrees Celsius: 15.5
Enter the three dimensions, height, width and length, of the room in meters:
2.25
5.55
12.15
Enter a time in minutes: 30
When there are 35 students in a room of dimensions:
Height 2.25 m x Width 5.55 m x Length 12.15 m,
And when the temperature is 15.50 degrees Celsius, after 30.00 minutes,
The final temperature of the room will be 53.99 degrees Celsius.
Process returned 66 (0x42) execution time : 23.528 s
Press any key to continue.

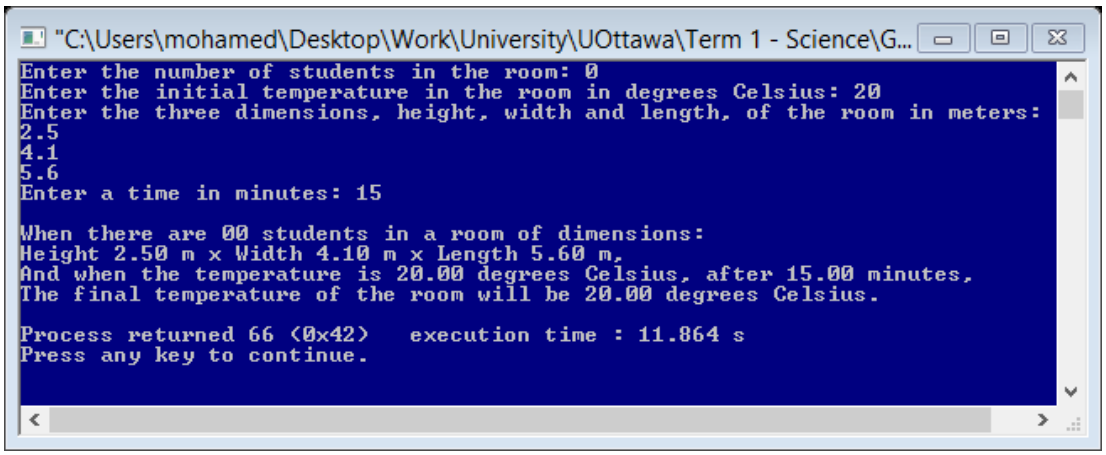
5-


"C:\Users\mohamed\Desktop\Work\University\UOttawa\Term 1 - Science\G...
Enter the number of students in the room: 10
Enter the initial temperature in the room in degrees Celsius: 25
Enter the three dimensions, height, width and length, of the room in meters:
3.5
15.5
21.4
Enter a time in minutes: 15
When there are 10 students in a room of dimensions:
Height 3.50 m x Width 15.50 m x Length 21.40 m,
And when the temperature is 25.00 degrees Celsius, after 15.00 minutes,
The final temperature of the room will be 25.73 degrees Celsius.
Process returned 66 (0x42) execution time : 21.398 s
Press any key to continue.

6-


"C:\Users\mohamed\Desktop\Work\University\UOttawa\Term 1 - Science\G...
Enter the number of students in the room: 2
Enter the initial temperature in the room in degrees Celsius: 20
Enter the three dimensions, height, width and length, of the room in meters:
2.5
4.1
5.6
Enter a time in minutes: 15
When there are 02 students in a room of dimensions:
Height 2.50 m x Width 4.10 m x Length 5.60 m,
And when the temperature is 20.00 degrees Celsius, after 15.00 minutes,
The final temperature of the room will be 22.91 degrees Celsius.
Process returned 66 (0x42) execution time : 59.639 s
Press any key to continue.

7-


"C:\Users\mohamed\Desktop\Work\University\UOttawa\Term 1 - Science\G...
Enter the number of students in the room: 0
Enter the initial temperature in the room in degrees Celsius: 20
Enter the three dimensions, height, width and length, of the room in meters:
2.5
4.1
5.6
Enter a time in minutes: 15
When there are 00 students in a room of dimensions:
Height 2.50 m x Width 4.10 m x Length 5.60 m,
And when the temperature is 20.00 degrees Celsius, after 15.00 minutes,
The final temperature of the room will be 20.00 degrees Celsius.
Process returned 66 (0x42)   execution time : 11.864 s
Press any key to continue.