Indian Institute of Engineering Science and Technology, Shibpur

B.Tech CST 4th Semester Final Examinations, May 2021

Programming Paradigm CS-2203

Full Marks: 50 **Time: 1 hour 30 Minutes**

Attempt all questions

1. Attempt **any 7** from the following 10 questions

a) What do you understand by the term "Referential Transparency" in the context of functional programming?

b) Consider `m` and `n` be two non-negative integers. Develop a Scheme LISP function for the following -

```
F(m, n)     =  n+1                      if m=0
            =  F(m-1, 1)                if m>0, n=0
            =  F(m-1, A (m, n-1))       if m>0, n>0
```

c) Describe the features those differentiate procedural programming and object oriented programming.

d) What do you understand by the terms 'state', 'behaviour' and 'identity' of an object?

e) "*Inline function speeds up execution and decreases the executable code size*" – is this correct statement regarding inline function? – explain.

f) If a class defines one of these (copy constructor, assignment operator, destructor), it should define all of them (the so-called "*law of the big three*"). Why?

g) Mention the difference between a "non-static member function of a class" and a "non-member function" in C++?

h) Explain dynamic polymorphism using a sample C++ code.

i) What is multi-level inheritance? Explain using a C++ sample code.

j) Write a short note on "UML Usecase Diagram".

[7x5 = 35]

2. A thermostat is a regulating device component which senses the temperature of a physical system (censor) and performs actions so that the system's temperature is maintained near a desired setpoint. Consider the class `ThermostaticHeater` that represents a thermostatically controlled home heating system that has at least following attributes and behaviours.

```
int tempeLimit;          // temperature from 0 to 30 (celsius)
bool heaterState;        // true or false (for on/off)
void evaluateState();    // switch heater on/off as needed
int getCurrentTemp();    // obtain temperature from sensor
bool getCurrentState();  // report whether on or off
```

a) Provide the `ThermostaticHeater` class design that uses appropriate access modifiers.

b) Provide a getter and a setter method that will enable the `tempLimit` instance variable to be retrieved and modified.

c) Provide a constructor for the `ThermostaticHeater` class that will initialise the instance variables to suitable (valid) start values.

d) Write a body for the `evaluateState()` method that enables it to switch the heater on and off (by updating the `heaterState` instance variable, where appropriate) by comparing the current value of `tempLimit` with the current temperature, as returned by the method `getCurrentTemp()`.
[*Note that you don't have to write the function body of `getCurrentTemp()` method*].

e) Write the `main()` function that instantiates the `ThermostaticHeater` class and demonstrates that the setter and getter methods you designed in part (b) behave correctly.

[5x3 = 15]