01692

Sri Lanka Institute of Information Technology

B.Sc. Honours Degree in Information Technology

Specialized in Information Technology

Final Examination
Year 1, Semester 2 (2024)

IT1050–Object Oriented Concepts

Duration: 2 Hours

May/June 2024

Instructions to Candidates:

- This paper has 4 questions.
- Answer all other questions in the booklet given.
- The total marks for the paper is 100.
- This paper contains 7 pages, including the cover page.
- Electronic devices capable of storing and retrieving text, including calculators and mobile phones are not allowed.
- This paper is preceded by 10 minutes reading period. The supervisor will indicate when answering may commence.

Question 01 (40 Marks)

Write the answers to the following questions.

a) Name the 5 features of Object-Oriented Programming. (5 marks)

b) Briefly explain "polymorphism' with an example. (4 marks)

c) "Encapsulation and Information hiding both refer to the same concept in object orientation." Do you agree with this statement? Justify your answer for the choice. (5 marks)

d) Consider the description given below and answer the questions.

A library contains books and journals. There can be several copies of a given book. All books can be borrowed by any library member for three weeks. Members can borrow up to six books at a time, but only VIP members can borrow e-copies of books. All members can borrow any number of journals.

i) Identify and list the classes in the above scenario. (4 marks)

ii) Draw the UML diagram for the above scenario with proper relationships and multiplicities. You don't need to specify the attributes and methods. (4 marks)

e) Consider the code below and answer the questions.

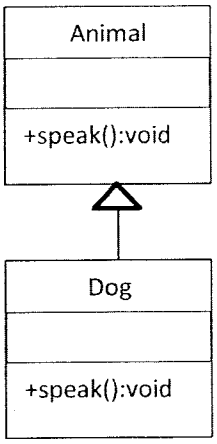
```
#include <iostream>
using namespace std;

class Person {
private:
    string name;
    JobExperience* job;
```

```
public:
    Person (string pname, JobExperience *jobExperience)
   {
         strcpy (name, pname)
         job = jobExperience

  }

};


class JobExperience {
private:
    string position;
    string company;

public:
    JobExperience(string position, string company)
    {
         strcpy (post, position)
         strcpy (firm, company)
    }

};


int main() {

    JobExperience *experience1("Software Engineer", "ABC
Corp");
    Person *person("John Doe", experience1);

    return 0;
}
```

i) What is the relationship shown in the code above? (2 marks)

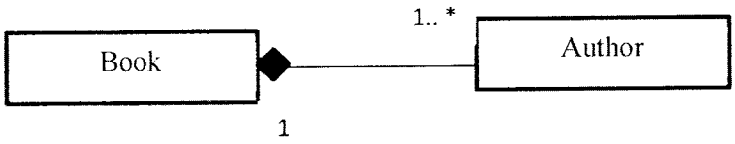
ii) Draw the UML diagram to show the relationship shown in the code. (4 marks)

f) Consider the following UML diagram and the given C++ code. Fill in the blanks. Follow the given hints near each blank. (3 marks)




```
#include <iostream>

class Animal {
public:
  virtual ~Animal() = default;
    1
      // hint: Pure virtual function for polymorphism

};

class Dog  2                  { //hint: inheritance
public:
    3

//hint: overridden function
  {
    cout << "Woof!" << endl;
  }
};
```

g) Consider the following UML diagram and write the C++ coding with necessary attributes and methods only to show the relationship between the two classes. (5 marks)



h) Discuss the role of abstract classes in Abstraction and Polymorphism in C++.? (4 marks)

Question 02 (20 marks)

Given below is a set of requirements for a **Virtual Fitness Coaching System (VFCS).** Analyse the given requirements and answer the questions.

In today's health-conscious world, maintaining a consistent fitness routine, receiving personalized coaching, and effectively tracking progress are essential for achieving fitness goals. To meet these needs, the **Virtual Fitness Coaching System (VFCS)** has been designed as a comprehensive software solution.

Features of Virtual Fitness Coaching System (VFCS):

The VFCS empowers users to create customized workout plans tailored to their individual needs. Whether aiming for weight loss, muscle gain, or improved endurance, users can specify their fitness goals. The system then suggests appropriate exercises based on these goals.

The standout feature of VFCS is its virtual coaching sessions. These sessions are arranged, managed, and conducted entirely by the system. Users can participate in real-time workouts led by professional trainers through video demonstrations. Coaches provide valuable form corrections and motivation during each exercise.

To complement physical activity, VFCS includes nutrition tracking. Users can log their daily meals, monitor calorie intake, and make informed dietary choices. The system generates personalized food

plans, considering dietary preferences such as vegan or gluten-free options, as well as specific nutritional requirements. Furthermore, the system suggests suitable corrective actions in situations where the dietary requirements are not met by users.

VFCS encourages engagement through system-wide fitness challenges. Users can participate in these challenges, competing with others to achieve specific fitness milestones. The system tracks individual progress, awards badges for achievements, and displays leaderboards. This friendly competition fosters consistency and motivates users to stay active.

Security and privacy are one of the key features of the system. VFCS implements role-based access control to ensure appropriate data access levels. The following roles exist:

- Users: Can create and manage workout plans, track progress, and participate in challenges.
- Coaches: Have access to user progress for coaching purposes.
- Administrators: Can view all data for system management.

VFCS further provides valuable insights into users' fitness journeys. Weekly reports highlight workout consistency, calorie burn, and muscle development. Visualizations help users understand their progress and make informed decisions. These reports can also be viewed by coaches.

The Virtual Fitness Coaching System (VFCS) seamlessly integrates personalized coaching, nutrition management, and community engagement to empower users on their fitness quests.

a) List the five rejecting rules and write all the nouns in the above description that will be eliminated under each rule. (5 marks)

b) Identify and list the classes in the above scenario. (5 marks)

c) Draw the CRC cards for any 5 classes you have identified in part b). (10 marks)

Question 03 (20 marks)

Consider the following description and draw the class diagram. Clearly show the classes, relationships and multiplicity using UML notations.

The **Animal Shelter Management System (ASMS)** is a web-based system designed to effectively track animal intake, adoption, care, and other activities within an animal shelter.

Shelter adopts two types of animals namely Dogs and Cats. When an animal is brought to the shelter, their information is entered to the system along with a unique id. Animal information include species, breed (optional), age, arrival date, and medical history. For Dogs Size (small, medium, large), energy level (low, medium, high), and house-training status (trained, not trained) are recorded and for Cats Coat type (short hair, long hair), temperament (playful, aloof, affectionate), and declawing status (declawed, not declawed) are recorded. Details such as dog size, dog energy level, cat's temperament and declawing status can be updated in the system.

Shelter is associated with two types of users, namely staff members and adopters. Staff members assist with daily animal care. They work in the animal shelter fulltime. Their ID, name, contact information and schedule will be saved in the system. When a new animal is taken in, a staff member must register the animal in the system. The schedule is created by the shelter owner in the start of each week, who is also a staff member.

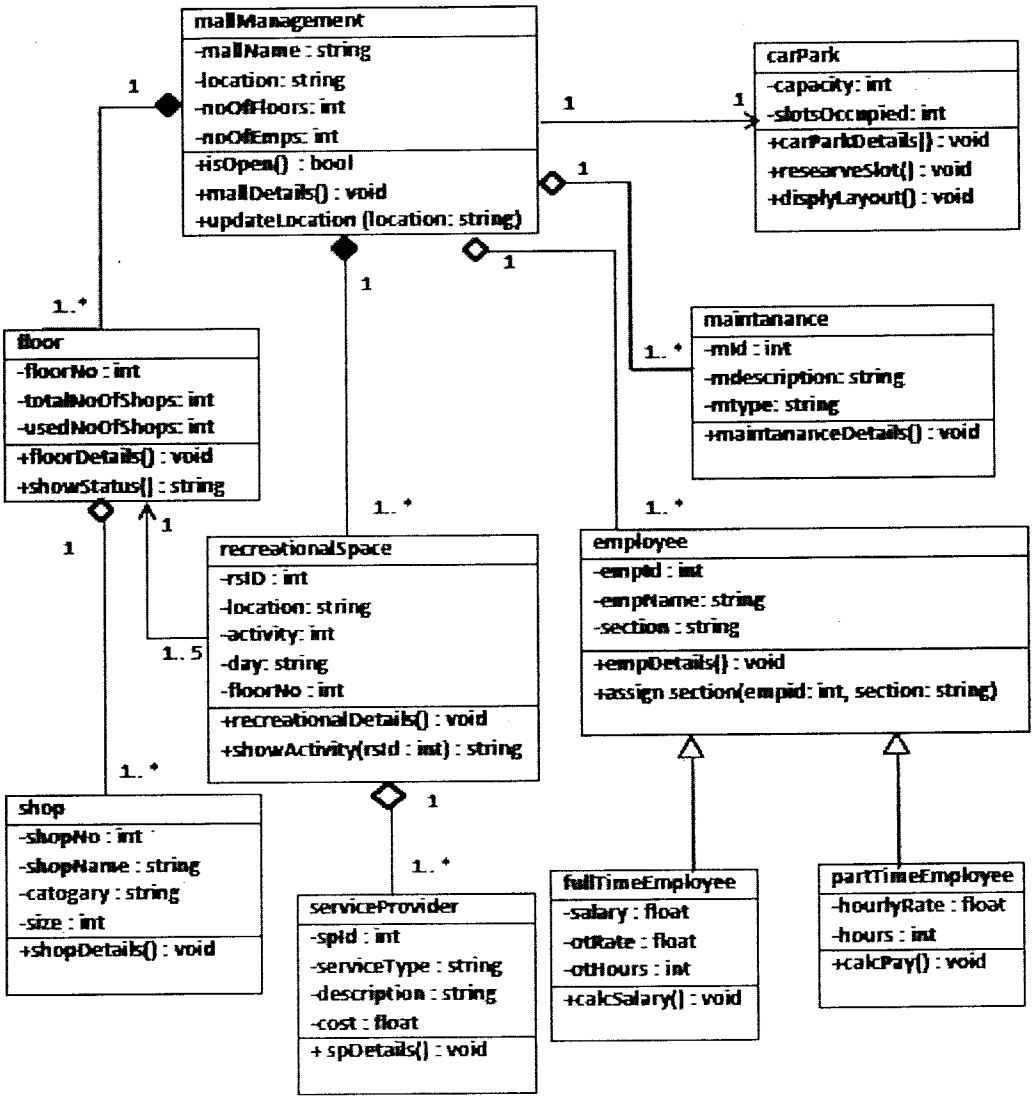
Adopters are individuals adopting animals. When an animal is given for adaptation the adapters details such as ID, name and contact information will be stored. When an animal gets adapted, the status of the animal in the system is changed to adopted by staff members. After adaptation, adopter will get the full access to the animal data in the system including the medical history. Further adapter needs to update the status of the adapted animal/s to the system every month. This way the shelter keeps track of its former members to ensure they are treated well. Maximum number of animals that can be adopted by a single adopter is 5.

Animals will be treated for any illnesses during the stay at the shelter. All these data regarding medical treatments including treatment ID, date, description of treatment, prescribed drugs and associated cost will be saved in the system for each animal. Any vaccinations conducted during the

stay at shelter will also be added under medical history. In Addition to the above features ASMS is equipped with a report generation feature. Reports can be generated by staff members on animals, adoption rates, and work hours.

Question 04 (20 marks)

Consider the following class diagram and write the C++ code for the classes shown in the diagram. (Add methods with implementations ONLY when you need to show the relationships)



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