

BIRLA INSTITUTE OF TECHNOLOGY & SCIENCE, PILANI (RAJASTHAN)

First Semester, 2023-2024

35 Marks (35% Weightage)

Mid-Semester Test

Open Book

Course Number: CS / SS G514
Date : October 09, 2023

Course Title: Object Oriented Analysis & Design
Time : 04:00 PM – 05:30 PM

Note: There are four questions in all. Please answer all parts of a question in sequence and in continuation.

Q1. Answer the following with respect to the problem description given in the Table Q1.

- 1.1 Draw the class diagrams with appropriate relationships.
- 1.2 Draw the inheritance tree.
- 1.3 Since there can be polygons with number of sides more than ten, what should be done in OO paradigm to incorporate these types of the polygons?
- 1.4 During a future phase of development when the user interactions are planned to be stored in a database, which type of database Relational Database or Object Relational Database is preferred and why?
- 1.5 Draw the use case diagram with respect to classification of the sequence of the vertices as a polygon?
- 1.6 Assume that over the time it is decided to develop the system for concave polygons (a concave polygon has at least one interior angle $> 180^\circ$) also. What changes have to be made to the inheritance tree?

It is required to develop a computer program to classify a sequence of vertices as forming a type of polygon along with its subtype and wherever appropriate also to classify as sub-sub-type. For example, if a sequence of three vertices makes a triangle then the polygon type is Triangle and its subtype can be like right-angle, isosceles, equilateral etc. Similarly for a quadrilateral its sub types can be rectangle, parallelogram, trapezium, other etc. and also some of these may have further sub-sub-type quadrilateral (e.g. square is a sub type of rectangle). A polygon with number sides exceeding four is just classified as regular (when all sides are equal in length) or irregular. As of now the following limitations are there: 1). Only the polygons up to maximum of ten sides need to be classified, 2). Only convex polygons (i.e. polygons with all its interior angles strictly less than 180°) are to be given as input, and 3) the program does not records in storage or database any of its execution traces with respect to input, internal processing or output.

Marks Q1 [2.5 x 6 = 15]

Table: Q1

Q2. Write in tabular form two contrasting differences between:

- 2.1 Concrete class and abstract class
- 2.2 Protected visibility and Private visibility
- 2.3 UML Sequence diagram and UML activity diagram
- 2.4 Component and Interface.
- 2.5 Link and Association.



Marks Q2 [(0.5 + 0.5) x 5 = 5]

Figure: Q3 ↑

Q3. An assembly can be composed of certain number of parts and each part in a specified count (or quantity). However, a part itself can be an assembly (e.g. in the figure Q3, the refill is an assembly being used in a ballpoint pen assembly). For an object oriented system to be developed to maintain these assembly related data, answer the following:

- 3.1 Draw necessary relationships.
- 3.2 There is always an order to be followed for assembling the parts to get an assembly. For this purpose, is the splitting of control and synchronization of control required? If yes, draw diagram for the case of Ballpoint pen shown in Figure Q3. If no, justify why these two are not required.

Marks Q3 [2.5 + 2.5 = 5]

Q4. Identify five classes and two operations for each class with respect to the Graphical User Interface (GUI) for a pie-chart drawing utility similar to the one shown in the figure *Given GUI* if the buttons (shown as small squares in top-right portion of the GUI screen i.e. squares drawn near the text 'foo', 'bar' etc.) are selectable by mouse. In the figure *Given GUI* the sectors start from the y-axis and drawn in clockwise direction as per the list, for example in this case starts at y-axis for 'foo', followed by 'bar' in the first octant and likewise for remaining also the traversing is in clockwise direction. Further description of the GUI is as follows:

- After clicking a square-shaped button the corresponding partition (sector) in the chart is enclosed by solid black boundary.
- After clicking for at the partition (sector) in the draws a solid boundary about the corresponding button.
- After clicking at blank area in the GUI window the previously drawn solid boundary gets erased.
- Clicking at the *close icon* (X shaped icon in right top portion) closes the GUI, clicking at maximize icon (square-shaped icon in right top portion) maximizes the GUI window and clicking at minimize icon (long dash-shaped icon in right top portion) minimizes the GUI window.

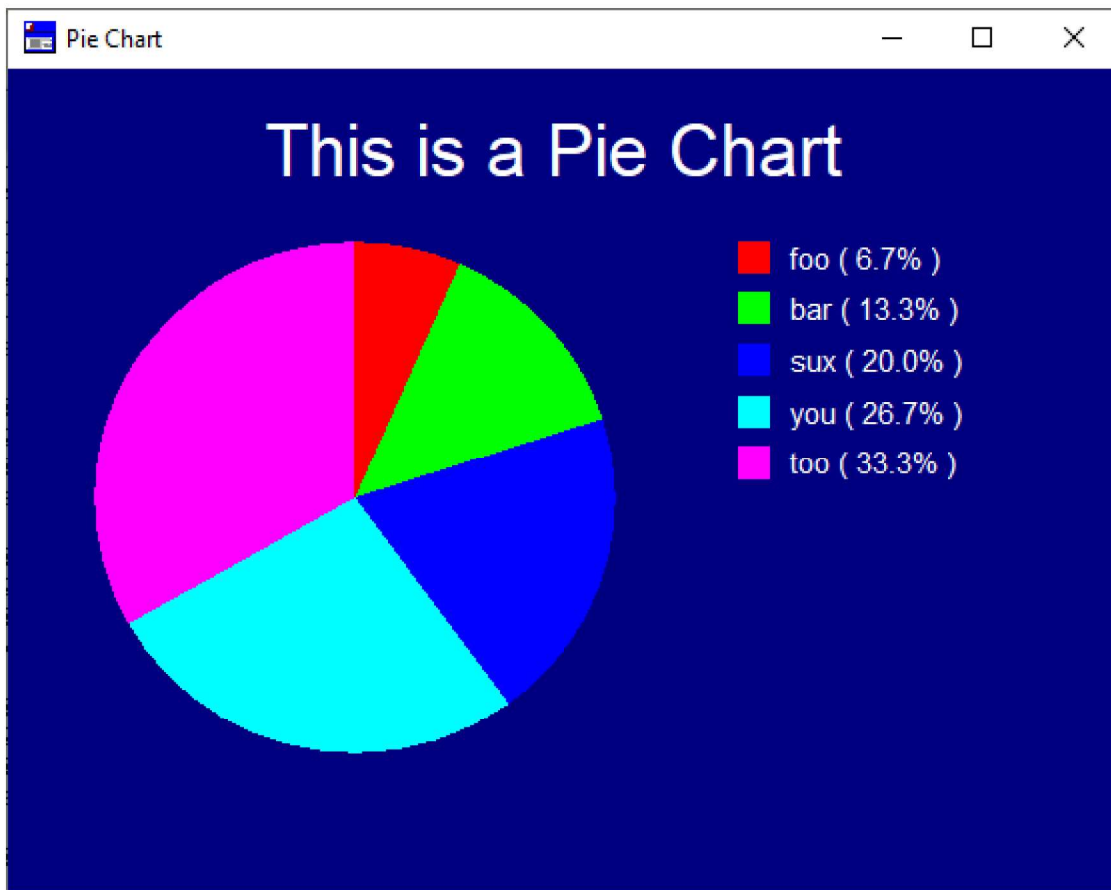


Figure: *Given GUI* ↑

Marks Q4 [(1+0.5+0.5) x 5 = 10]