[Knowledge for Development]

# KIBABII UNIVERSITY

## UNIVERSITY EXAMINATIONS
## 2021/2022 ACADEMIC YEAR

## END OF SEMESTER EXAMINATIONS
## YEAR ONE SEMESTER ONE EXAMINATIONS

## FOR THE DEGREE OF MASTER OF SCIENCE
## (INFORMATION TECHNOLOGY)

COURSE CODE  :  MIT 813

COURSE TITLE  :  OBJECT-ORIENTED
ANALYSIS AND DESIGN

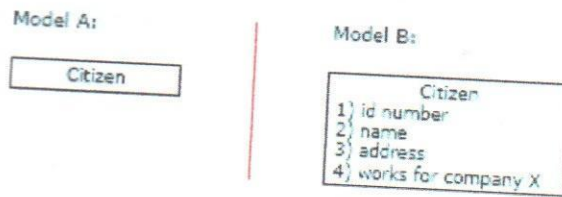DATE: 17/06/2022                    TIME: 9.00 A.M- 12.00 NOON
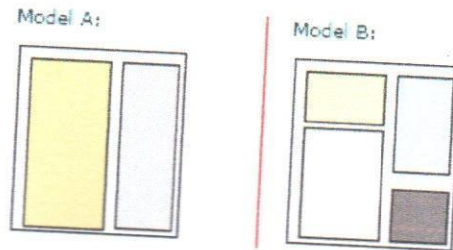
INSTRUCTIONS TO CANDIDATES:

ATTEMPT ANY OTHER THREE (3) QUESTIONS

## Question 1

a) Which of the following models A and B is more abstract? Justify your answer. **[3 marks]**

**[20 marks]**

Model A:

| Citizen |

Model B:

| Citizen<br>1) id number<br>2) name<br>3) address<br>4) works for company X |

b) Suppose A and B are models of the same system. Which of them is more modular? [2 mark]

Model A:

Model B:

c) Distinguish between sequence diagram and collaboration diagram. **[4 marks]**

d) Using an example explain what is meant by recursive/reflexive association stating reasons why it will be important to name the roles of each object. **[3 marks]**

e) Using an example distinguish between composite aggregation and shared aggregation relationships. **[4 marks]**

f) Distinguish between analysis and design in object orientation. **[ 2 marks]**

g) Complex systems can be viewed by focusing on either things or processes. Outline some reasons for applying object-oriented decomposition, in which we view the world as a meaningful collection of objects that collaborate to achieve some higher-level behavior.

**[2 marks]**

## Question 2

**[20 marks]**

Consider a software house that employs several programmers. Each is given a unique payroll number. His name and monthly salary are recorded. The programming language used is also recorded but it is expected to change from time to time. It should be possible to get a display showing the details of each programmer and a monthly salary bill for the software house. All of the software house employees, not just programmers, are given a payroll number and their name and salary are to be recorded. The software house has project leaders. A project leader is a programmer responsible for a team of programmers. He is given a 10% monthly salary bonus for each member in the team. The display of a project leader should include a display of each programmer assigned. It is also specified that if a programmer uses Java then a 20% bonus is awarded.

a. List the essential objects from the above description. **[6 marks]**

b. Eliminate any inappropriate candidate objects giving the criteria for rejecting the object. **[4 marks]**

c. Identify all the specialization/generalization hierarchies in the description above. **[4 marks]**
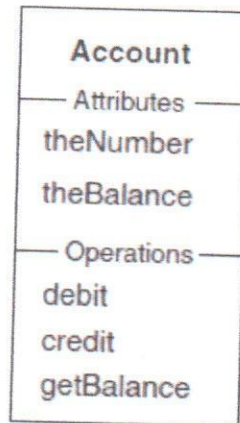
d. Draw the class diagram

[6 marks]

## Question 3

[20 marks]

a) Explain why modelling is central to many human activities. Describe one example for the use of models.

[5 marks]

b) Object-oriented development processes employ **iterations** and **increments**. Outline what you understand by these terms in bold.

[4 marks]

c) Give a UML class diagram for the class **Person** with **theName** and **theDateOfBirth** attributes as well as the operations **getName**, **getAge** and **changeName**. Show two instances of class **Person** in an object diagram representing yourself and someone in your class.

[8 marks]

```
┌─────────────────────┐
│      Account        │
├─── Attributes ──────┤
│   theNumber         │
│   theBalance        │
├─── Operations ──────┤
│   debit             │
│   credit            │
│   getBalance        │
└─────────────────────┘
```

*Class diagram with Account class*

d) The **Account** class above shows two attributes and three operations.

   i.   The enquiry operation **getBalance** interrogates an **Account** object for part of its state. Which attribute value is returned by this operation? [1 mark]

   ii.  How is this value used when implementing the additional operation **isOverdrawn** that indicates the state of an **Account** object? [2 marks]

   iii. When we **debit** or **credit** an **Account**, which attribute value is affected? By what amount is it changed? [2 marks]

## Question 4

[20 marks]

a) A company maintains a record for each of its employees. The employee details include their (unique) employment number, their name, age, sex and salary. A system is required to hire new employees and to produce the following reports: the complete staff list, a list of those staff for a given sex, a list of staff over a certain age and the total wage bill for the company.

   i.   Compose use-cases to capture the required functionality [4 marks]

   ii.  Identify the major classes present [2 marks]

   iii. Construct a class diagram showing any architectural relations [4 marks]

   iv.  Identify the most important operations and attributes for each class [4 marks]

b) Academic staff in a university are designated as either a lecturer or a senior lecturer. Both teach students but a lecturer does a small amount of research while a senior lecturer is expected to do significantly more. Construct a class diagram for academic staff.

[6 marks]

## Question 5
[20 marks]
a) Outline any three attributes of well-organized packages.
[3 marks]
b) Complexity often takes the form of a hierarchy; it is useful to model both the is a and the part of hierarchies of a complex system. Explain using examples the difference between two hierarchies.
[4 marks]
c) When discussing complex systems, we talk about separation of concerns. Explain what separation of concerns means high lighting decomposability and component linkages.

[3 marks]
d) Many complex systems are implemented with "**an economy of expression**". Explain the quoted statement.
[2 marks]
e) The object model encompasses the principles of abstraction, encapsulation, modularity and hierarchy. Define the underlined terms.
[4 marks]
f) When designing a complex software system, it is essential to decompose it into smaller and smaller parts, each of which may then be refined independently. Name and describe the two types of decomposition.
[4 marks]