INSTRUCTIONS TO CANDIDATES

1. This paper consists of THREE sections.

2. Answer ONE question from EACH section.
SECTION A

MODULE 1: SOFTWARE AND SYSTEM DEVELOPMENT

Answer ONE question from this section.

1. Consider the scenario below on booking procedures in a travel agency, and answer the questions that follow:

A customer provides necessary travel information and receives a six-letter ticket locator to reserve his seat. The customer can pay immediately or within twenty-four hours, but the ticket locator number must be used to reference the customer’s travel information. Once payment is made, the customer receives his official flight itinerary.

(a) Identify ONE external entity.  
   [1 mark]

(b) Draw a Context Diagram for the above scenario.  
   [4 marks]

(c) Identify TWO data stores that would be necessary in the scenario above.  
   [2 marks]

(d) Create a level 1 Data Flow Diagram (DFD) of the above scenario.  
   [13 marks]

(e) Draw ONE Entity Relationship Diagram (ERD) from the scenario. You must include the cardinalities.  
   [6 marks]

(f) Create a Data Dictionary for the external entity identified in (a), using ONE field.  
   [4 marks]

Total 30 marks

2. (a) Users of software applications sometimes have difficulty with certain aspects of the software. Describe THREE aspects during software use that would indicate poor engineering.  
   [9 marks]

(b) With regard to the design phase during the development of a software system:

(i) Name and briefly discuss THREE important activities that occur during this phase.  
   [6 marks]

(ii) Explain the usefulness of CASE tools during the design phase.  
   [3 marks]

(c) Explain THREE useful rules that guide the design of a user interface during software development.  
   [6 marks]

(d) (i) Identify THREE persons that should be consulted during the development of a software product.  
   [3 marks]

(ii) Explain why it is important to involve the persons identified in (d) (i).  
   [3 marks]

Total 30 marks

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SECTION B

MODULE 2: PROGRAMMING LANGUAGES

Answer ONE question from this section.

3. (a) Name EACH of the programming languages developed from the first generation to the fifth generation. [5 marks]

(b) Write an algorithm that reads a positive integer $n$, then finds and prints the sum of all integers between 1 and $n$ (inclusive) that are divisible by 5. The print statement should be useful. [6 marks]

(c) The following algorithm is supposed to print double each number for numbers between 1 and 100 (inclusive). The algorithm however, is not generating the desired output.

```
1     Big = 1
2     i = 1
3     WHILE Big <= 100
4     PRINT 2 * Big
5     i = i + 1
6     END WHILE
```

(i) What is the output of the algorithm? [1 mark]

(ii) Explain the error in the algorithm. [1 mark]

(iii) Indicate the line number of the error and write the statement that would generate the correct output. [2 marks]

(d) Consider the following module:

```
MODULE CAPE (N: INTEGER)
    IF (N>0) THEN
        RETURN N * CAPE (N-1)
    ELSE RETURN 1
END MODULE
```

(i) Write ALL steps that will produce the final result of the module for the statement CAPE (4). [11 marks]

(ii) What programming principle does the module illustrate? [1 mark]

(iii) For any number $N$, explain the general purpose of the module above. [3 marks]

Total 30 marks
4. (a) Write a simple algorithm to illustrate

(i) bounded iteration

(ii) unbounded iteration.

(b) The Flower Shoppe wishes to maintain information on all persons who have done business with them in the last year. The application should store personal information on the customer such as the name of the customer, identification number, address, and contact number. It should also store information on types of flower arrangements, which include the height and number of flowers in the arrangement. There is a flower price structure which is determined from the price of the arrangement plus a delivery charge. It should also note the ID of the employee who completed the arrangement.

(i) Identify TWO classes other than FlowerPrice in the application. [2 marks]

(ii) Suggest TWO attributes of EACH class identified in 4 (b) (i) above. [2 marks]

(iii) Write the specification for the Price class given that the class consists of three attributes, at least one accessor, one modification and one print method. [13 marks]

(iv) Draw a class diagram for FlowerPrice class. [7 marks]

Total 30 marks
SECTION C

MODULE 3: PROGRAM DEVELOPMENT

Answer ONE question from this section.

5.  (a) One dimensional arrays are used to implement a Stack ADT stack1 containing letters A to D and a Queue ADT queue1 containing numbers 1 to 4. The letters were added to stack1 in the order A, B, C, D and the numbers were added to queue1 in the order 1, 2, 3, 4.

(i) Sketch stack1 and queue1. Draw an arrow to indicate the
a) top of the stack1
b) front of the queue1.

(ii) State what is returned from the operation isEmpty() if there are no elements currently in the stack.

(iii) State and explain TWO other typical ADT operations for EACH of stack1 and queue1.

(iv) Assume stack1 was initially empty. Write a sequence of stack operations, to add the letters, C, A, B, (in that order) to the stack.

(v) Assuming the letter A corresponds to 5, B to 6, C to 7, and D to 8, write a sequence of statements including stack operations and queue operations, to move the letters, C, A, B, from the stack and add the corresponding numbers to an empty queue, queue1. Note that after your statements are executed, stack1 would be empty.

(vi) Write statements to remove the elements from queue1, one by one and print EACH element as it is removed. Write down the output printed.

Total 30 marks
6. (a) You wish to create your own chat program, using a Graphical User Interface in an event driven programming environment. The program should display the list of your contacts, and have an area for the user to type in the message. When the user presses SEND, the message is also displayed below the contact’s previous message.

(i) Identify THREE types of controls or Graphical User Interface objects that should be present in the user interface and explain the role of EACH in the program. [8 marks]

(ii) Briefly discuss TWO events that the program should anticipate. [4 marks]

(iii) Design a layout of the user interface, and clearly label the controls used. [6 marks]

(b) The Chronic Disease Centre wishes to maintain information on all persons in the country who have had a stroke for the first time. The application should store personal information on the patient such as the name of the patient, ID, date of birth, address. It should also store information on their stroke, such as type of stroke, date of stroke, date of admission, date of discharge, limb or speech problem, and any physiotherapy needed. The length of stay is calculated from the date of admission and the date of discharge from the hospital. Finally, the application should store the name of their personal doctor, doctor’s identification, address and contact numbers.

Using a language of your choice, write the code for a Stroke class, using the specifications outlined below.

Instance variables:

id: identification number of patient
patients: an array containing the list of patients
stroke type: a string containing the type of stroke
disability: string containing disability after stroke
numPatients: the number of patients who had a first time stroke

Constructor:

The Stroke class should include a constructor that supplies the identification number of the stroke patient as a parameter.

Methods:

addPatient: adds a Patient object to the Stroke list. Assume that there are at most 2000 patients with first time strokes.
printPatients: displays all the patients in the list.

[12 marks]

Total 30 marks

END OF TEST