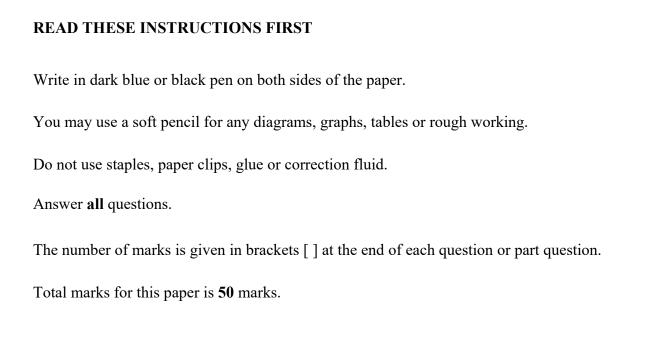
HWA CHONG INSTITUTION C2 BLOCK TEST 2020

COMPUTING Higher 2 Paper 1 (9569 / 01)

30 June 2020 Paper 1 (9569 / 01) 0815 -- 0945 hrs



1. The Human Resource department of an organization would like to develop a system using object-oriented approach to manage the information of the employees. One of the functions of the system is to compute the monthly pay of the full-time employees which comprise of the monthly salary and the overtime allowance. Due to the rapid expansion of the organization, the organization starts to employ daily-rated employee. For daily-rated employee, their monthly pay are computed based on the rate per day and the number of days worked per month. (a) Draw a class diagram which exhibits the following: Suitable classes with appropriate properties and methods Inheritance Polymorphism [6] (b) Explain how your design in (a) demonstrates code reuse. [2] (c) Explain the term **polymorphism** and how it is applied in your design in (a). [2] 2. A queue data structure is implemented using an array Queue and two pointers, Head and Tail. The space in array is fully utilized to perform the queue operations. Queue: 1-dimensional array with index 1 to 10 Head: pointing to the index of the first item in the queue Tail: pointing to the index of the next item that is inserted (a) Describe an algorithm, using pseudocode, to insert a new item NewItem into the queue. [4] (b) Describe an algorithm, using pseudocode, to delete an item from the queue. [6] (c) Peter intends to use the pseudocode Length ← Tail – Head to find the length of the queue. Give an example to explain why he fails. Write down the correct pseudocode to find the length. [3] (d) This data structure can also be implemented using linked list. Give one advantage and **one** disadvantage of linked list over array implementation. [2]

3. (a) The following is an algorithm for an insertion sort procedure.

```
PROCEDURE sort ( A, n )
     {insertion sort the array A, items 1 to n}
     IF n > 1 THEN
         sort ( A, n - 1 )
          insert ( A, n - 1, A[ n ] )
     ENDIF
ENDPROCEDURE
PROCEDURE insert ( A, i, X )
     {the array A has items 1 to i already sorted;
     insert the item X into position to make items 1
     to i + 1 sorted}
     IF i = 0 THEN
         A[ 1 ] ← X
     ELSE
          IF X > A[i] THEN
              A[i+1] \leftarrow X
         ELSE
              A[i+1] \leftarrow A[i]
              insert ( A, i - 1, X )
         ENDIF
    ENDIF
ENDPROCEDURE
```

Illustrate the operation of procedure **insert** (A, 4, X) where

```
A[1] is 'Amy'
A[2] is 'Ben'
A[3] is 'Ken'
A[4] is 'Tim' and
X is 'Jin'
```

by completing the trace table given below.

	A[1]	A[2]	A[3]	A[4]	A[5]	i	X
<pre>insert(A,4,'Jin')</pre>	Amy	Ben	Ken	Tim		4	Jin
<pre>insert(A,3,'Jin')</pre>							

	` /	e an algorithm, in pseudocode, for a non-recursive version of the insertion sort to tems held in an array in ascending order. [6]						
		(c) Identify two features of the array that would have an impact on the performance of this insertion sort algorithm in (b) . [2]						
	(d) State in	the time complexity of the sort algorithm in (b) if items in the array are initially	y					
	(i) (ii)	reverse order [1 sorted order [1						
	What	is the maximum number of comparisons needed to sort an array of N items? [1]]					
4.	decides to	perator operates 4 malls in Singapore. Due to the recent outbreak, the mall operator of develop a centralized system to accurately limit the number of people entering mises to prevent overcrowding.						
	to capture	hall, there will only be one entrance and one exit. There is a sensor at the entrance of the timestamp when a person enters the mall. At the exit, there is also one sensor the timestamp when a person exits the mall.						
	(a) The n	nall operator wants to model this system using a relational database.						
	(i)	A database needs a number of tables to store the data for this system. Draw the Entity-Relationship (E-R) diagram to show the tables in third norma form (3NF) and their relationships between them. [4]						
	(ii)	A table description can be expressed as:						
		TableName(Attribute1, Attribute2, Attribute3,)						
		The primary key is indicated by underlining one or more attributes. Foreign keys are indicated by using a dashed underline.	n					
		Using the information given, write table descriptions for the tables you identified in (a) (i). [4						
	(b) State	two reasons why the mall operator may wish to choose a NoSQL database. [2	[,]					