HCI Computing 2011 Prelim Paper 1 Solution Guide

1.	(a)	i. Encapsulation is combining together methods and attributes as a single object type. e.g. Employee class combines the attribute Employee Name and the methods Show( ), Set_Employee Name( ) and Get_Employee Name( ) as a single entity.	[2]
		ii. Inheritance refers to the ability to create of new classes (subclasses) which inherit all the attributes and methods of an existing class (superclass). e.g. Classes Payroll Employee and Salaried Employee inherit the attribute Employee Name from class Employee and dosen't need to be declared in Payroll Employee and Salaried Employee	[2]
		iii. Polymorphism refers to the ability of different classes to respond to the same methods in different ways. e.g. Show( ) method for Payroll Employee may not display in exactly the same manner as Show( ) method for class Salaried Employee.	[2]
	(b)	In a class, data hiding can be achieved by declaring data members to be private so that the only way to access the data is through public methods.	[2]
	(c)	Add the following to Salaried Employee class • private attribute: yearly_bonus • public methods: Set_yearly_bonus( ) and Get_yearly_bonus( ) However, the question was phrased in such a way that the best answer would be to have a derived class from Salaried Employee.	[2]

	(d)	Method overloading is a feature that allows methods / functions with the same name but having a different number of parameters, or different types of parameters.
		
		e.g 1. Constructors can be overloaded to allow for multiple ways of creating an object.
		Employee( ); // constructor w/o parameters
		Employee(string) ; // constructor with 1 parameter
		
		e.g. 2.
		Set_annual_salary (float) // can accept a decimal value
		Set_annual_salary(int) // can accept an integer value
			[2]

2.	(a)	Student (SID, name, address, tel, email, dob,…) Staff (RmID, name, email, …) Course (CID, name, RmID, ….) CourseList (CID, SID, dateEnrolled, …)	[6]
	(b)	Use name to get RmID from staff table Use RmID to get CID from course table Use CID to get SID from courselist table Use SID to get student's name from student table	[4]

3.	(a)	Possible methods: • Database hacked • Trojan horse approach • snooping via wireless transmissions • User Negligence • Malware • Spams • Other acceptable answers • Phishing o Phishing is a way of attempting to acquire sensitive information such as usernames, passwords and credit card details by masquerading as a trustworthy entity in an electronic communication	[4]
	(b)	Description of another approach that is not mentioned in (a). The answer must put in the context of a banking transaction.	[2]
	(c)	Reason: • Easier to gain unauthorized access to card info as compared to gaining access to the physical card itself • Once account info falls into criminal hands there is a possibility of o Financial lost o Compromised on Privacy o Identity theft o Spams & Scams • Easy reuse of information gathered for future theft	[3]
	(d)	• 2 factor authentication: Serves as an additional layer of protection for users • Deter cybercrime with the use of device(card reader) • To generate another set of unique number • Eliminates possible cybercrime on 2nd factor with no connection to internet	[3]
	(e)	Highlight 2 other possible approaches Policy level • update password on a regular basis if not it will expiry • Expiry policies to suspend inactive accounts • Sending 2 factor unique ID via telecommunication devices, tokens etc	[4]

4.	(a)	• Geographical Range (WAN>LAN) • Speed of transmission (WAN>LAN) • Cost of setting up(WAN>LAN) because of devices in use • Different Networking standards (Ethernet VS T1 Standards) • Connection to public Network for WAN	[2]
	(b)	File Server • file server is a computer attached to a network that has the • primary purpose of providing a location for shared disk access	[2]
		Print Server • is a computer or device that is connected to one or more printers and to client computers over a network • can accept print jobs from the computers and send the jobs to the appropriate printers.	[2]
		Switch • Connecting multiple devices in a network • a switch determines from the physical device address in each incoming message frame which output port to forward it to and out of	[2]
		Router • join multiple wired or wireless networks together • An IP router such as a DSL or cable modem broadband router joins the home's local area network (LAN) to the wide-area network (WAN) of the Internet.	[2]
	(c)	• Topology - layout of the computers and devices in a communications network • Consist of a single central cable, to which all computers and other devices connect	[2]
	(d)	• Checksum is a fixed-size datum computed from an arbitrary block of digital data • Example stating o How the sum is calculated from source data o How to check that the transmitted data is correct at the other end of the transmission	[3]
	(e)	• Makes company information accessible to employees • facilitate working in groups • Restricted access • Enhanced security for transmission of sensitive information	[4]

5.	(a)	i. 280410 0*1 + 1*2 + 4*3 + 0*4 + 8*5 + 2*6 = 66 Since 66 mod 11 = 0, hence ID is valid	[1]
		ii. 503313 3*1 + 1*2 + 3*3 + 3*4 + 0*5 + 5*6 = 56 Since 56 mod 11 = 1, not zero, ID is not valid	[1]
	(b)	**Transcription error** - specific type of data entry error that is commonly made by human operators. Transcription errors are commonly the result of typographical mistakes, putting fingers in the wrong place during touch typing is the easiest way to ascertain this error.	[1]
		Examples of Transcription Error Input: 280420 (wrong) Instead of: 280410 (correct) Input Jishua (wrong) Instead of: Joshua (correct)	[1]
		Transposition error - occur when characters have "transposed" — that is, they have switched places. Transposition errors are almost always human in origin. The most common way for characters to be transposed is when a user is touch typing at a speed that makes them input one character, before the other. This may be caused by their brain being one step ahead of their body.	[1]
		Examples of Transposition Error Input: 280140 (wrong) Instead of: 280410 (correct) Input: Johsua (wrong) Instead of : Joshua (correct)	[1]
	(c)	1. Excluding the check digit, each digit of the ID is assigned a 'weight'. The right hand (least significant) digit is given a weight of 2, the next digit to the left 3 and so on. 2. Each digit is multiplied by its weight and the products added together. 3. The sum of the products is divided by 11 and the remainder obtained. 4. The remainder is subtracted from 11 to give the check digit. The two exceptions are: - If the remainder is 0, the check digit is 0, not 11. - If the remainder is 1, the check digit is X, not 10.	[4]

6.	(a)	• Binary search keeps **halving** length of **sorted** search string until element is found (or it is not in search string). • Sequential search looks at **every element in sequence** until element is found or string is exhausted.	[2]

(b) i.

- First=1, last=200
- Mid=201/2=100 → X(100)
- First=1, last=99
- Mid=100/2=50 → X(50)
- First=51, last=99
- Mid=51+99/2=75 → X(75)
- First=76, last=99
- Mid=87 → X(87)
- Therefore: elements examined: X(100), X(50), X(75), X(87)

[3]

ii.

Since $2^7 <= 200 < 2^8$, there would be a maximum of 8 comparisons.
or
int ($\log_2$ 200 + 1) = 8

[2]

iii.

Global variables are variables declared outside the scope of any function. All functions have the ability to access and modify global variables. [1]

Local variables are variables declared within a local function and they are only created and accessed when the function is called. The scope of access is limited to the function. When the function ends, the local variables within will be destroyed and does not exist anymore. An example is mid. [1] [1]

iv.

The array was often chosen as a parameter. However, there was no evidence in the question that any other array, apart from X, was to be used.

The two necessary parameters are:

- Number of items in the array, N -- passed by value.
  The actual value is passed and cannot be changed by the function. [2]
- Item to be located, item -- passed by value.
  The actual value is passed and cannot be changed by the function. [2]

(c)

13 : **13**
11 : **11** 13
24 : 11 13 **24**
12 : 11 **12** 13 24
20 : 11 12 13 **20** 24

[2]

(d)

```
// N is the size of the list, indexing starts from 1
read num
items[1] = num
for i = 2 to N Do
        read num
        j = i – 1
        while ( j > 0 ) and ( num < items[j] ) Do
                items[j+1] = items[j]
                j = j - 1
        endwhile
        items[j+1] = num
endfor
```

[5]

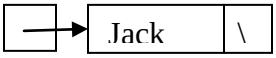
7. (a)

Individual List

Individual

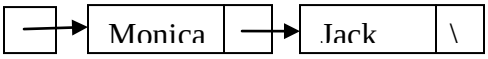
Create(Individual)

Individual



Insert(Individual, Jack, 1)

Individual

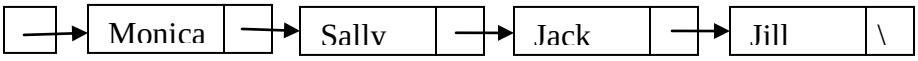


Insert(Individual, Monica, 1)

Individual

Insert(Individual, Jill, 3)

Individual



Insert(Individual, Sally, 2)

Individual

Delete(Individual, 3)

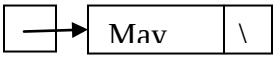
[3]

Group List

Group

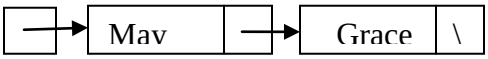
Create(Group)

Group



Insert(Group, May, 1)

Group



Insert(Group, Grace, 2)

[1]

(b)

```
Append(Individual, Group)            // append all items in Individual to Group
    for pos = 1 to Length(Individual)
        item = Retrieve(Individual, pos)
        Insert(Group, item, Length(Group)+1)
    endfor
endAppend
```

[4]

(c)

i.
```
Enqueue(QList, item)            //  add item to queue
    if  ( IsEmptyList(QList) )
        Insert(QList, item, 1)
    else
        Insert(QList, item, Length(QList) + 1)
    endif
endEnqueue
```
[2]

ii.
```
Dequeue(QList)                  //  delete item from queue
    if  ( IsEmptyList(QList) )
        print  "Queue is Empty "
        exit
    else
        print Retrieve(QList, 1)
        Delete(QList, 1)
    endif
endDequeue
```
[2]

8. (a)

- Modules can be kept in a library and re-used in other solutions
- Many programmers can work on same problem as each can be given different modules to solve
- Easier to maintain/modify as modules are small and can be removed/added easily

[3]

(b)

- Testing of individual modules,
- ie white box testing
- Testing of links between modules,
- ie black box testing
- Alpha testing:
- Beta testing:
- On site testing after implementation of the system

[6]

(c)

- Dfd – process modelling
- Er – data modelling
- Structured eng – logic modelling

[6]

(d)

(i)

- Worker id to ensure correct worker record is accessed
- Hours worked to enable calculation to be carried out

(ii)

- Worker id for printing on payslips
- Bank account details to ensure payment to correct account
- Amount of payment to ensure accurate payment

[5]