C2 PRELIMINARY EXAMINATION 2020

COMPUTING HIGHER 2 PAPER 1 (9569/01)

SUGGESTED SOLUTION

	Solution
1.	(i) One or more computers **acts as server;** Other computers **request service** from server (ii) **Advantage**: server can control the access rights of resources. If one client is down, the server and other clients are not affected. Resources can be updated faster, and it is easier to perform backup **Disadvantage**: If server is down, the whole network is down. Centralized server is more expensive to build up, and requires professional to maintain. (iii) DNS provides the directory service to **translation** from hostnames to IP addresses. Answers should provide an overview of the **hierarchical** decentralized naming system. (iv) *allow mistake in the words 'Discover, Offer, Request, Ack' Discover: **client broadcast** to look for a DHCP server Offer: DHCP **server offers** an address Request: **client requests to release** the address Ack: DHCP **server sends the address** to the client for acknowledgement
2.	(i) Any suitable answer (ii) Integrity: act with complete discretion when entrusted with confidential information. Unethical behaviour of leaking data or personal information Responsibility: carry out full responsibility in a professional manner, adhere to guidelines. Unethical behaviour of not carrying out duties Competence: innovate new technology or learn from other countries. Unethical behaviour of claiming programming proficiency in a language that he/she has never used.
3.	(a) **Data validation** ensures the input data conforms with the data requirements. ● Range check: 1<= month <= 12 ● Format check: date in the format dd/mm/yyyy ● Length check: length of password ● Presence check: username cannot be left blank ● Check digit: last digit of NRIC

Data verification ensures the input data matches the original resource
For example, double entry of password, proofread forms before submission

(b) Data is **separated** into packets and each packet **independently** find **the best route** to the receiver.
Advantage:

- Different packets may travel in **different** route and thus **more efficient**, **saves bandwidth** and **avoids congestion**.
- It is also more **secured** since it became much harder to attack **all the routes** instead of one routes in circuit switching network.

(c) Reason for layering: Enables programmers to specialize in a particular layer of the model.
Allows for standardized interfaces to be produced by networking vendors

Layer	Function
Application Layer	interacts with **end user**, create/format the data package OR Consists of **applications**/programs and processes that use the network
Transport Layer	**establish connection** between **applications** of the sender and the receiver OR provide **end-to-end** data delivery services
Internet/Network Layer	find the best **route** to deliver the data package OR defines the datagram and handles the **routing** of data
Physical/Link/ Network Access Layer	Transform data package to **electrical signals or radio waves** and transmit to the **physical devices** OR Consists of routines for accessing **physical medias**

4. (a) (i) 011 0100
(ii) 34_{16}

(a) 0000 0100 1011 0001

(b)

(i) A check digit is a redundant digit or letter calculated from digits of a code number. It is then added to the code number that permits the accuracy of other digits in the code to be checked.

(ii)

```
sum  0
weight  7
FOR i 1 TO  5
    sum  sum + INTEGER of account[i] * weight
    weight  weight – 1
ENDFOR

checkDigit  ASCII of (account[6])-ASCII of('C') + 1

totalWeightedSum  sum + checkDigit

IF totalWeightedSum MOD 11 = 0
    OUTPUT 'valid'
ELSE
    OUTPUT 'valid'
ENDIF
```

(iii) Not valid. The total weighted sum (including the cheek digit) is 160, which is not divisible by 11. Check digit should be E and not K.

5 (a)

```
# Assume the string index starts at 1
FUNCTION Encode(dataStr : STRING) RETURNS STRING
    result  ''
    prevChar  dataStr[1]
    prevCount  1
    FOR i  2 TO LENGTH(dataStr)
        currChar  dataStr[i]

        IF currChar = prevChar
            prevCount  prevCount + 1
        ELSE
            result  result + prevChar + str(prevCount)
            prevChar  currChar
            prevCount  1
        ENDIF
    ENDFOR
    result  result + prevChar + str(prevCount)
    RETURN result
ENDFUNCTION
```

(b)

```
FUNCTION SearchQinP(P:STRING, Q:STRING) RETURNS
INTEGER
    pSize  LENGTH(P)
    qSize  LENGTH(Q)

    match  FALSE
    index  1
    WHILE(NOT match)AND(index <= pSize - qSize + 1)
        extract  ''
        FOR i  index TO (index + qSize - 1)
            extract  extract + P[i]
        ENDFOR

        IF extract = Q
            match  TRUE
        ELSE
            index  index + 1
        ENDIF

    ENDWHILE

    IF match
        RETURN index
    ELSE
        RETURN 0
    ENDIF
ENDFUNCTION
```

6 (a)

(i) A function which contains a call to itself.

(ii) Should include at least one terminal case – a case that contains no further calls to the recursive subprogram so that it will not continue indefinitely.

(iii) Used when the original task can be reduced to a simpler version of itself

(b)

	OUTPUT
`Hanoi(3, 1, 3)`	
`Hanoi(2, 1, 2)`	
`Hanoi(1, 1, 3)`	
	`Move disc from peg 1 to peg 3`
	`Move disc from peg 1 to peg 2`
`Hanoi(1, 3, 2)`	
	`Move disc from peg 3 to peg 2`
	`Move disc from peg 1 to peg 3`
`Hanoi(2, 2, 3)`	
`Hanoi(1, 2, 1)`	
	`Move disc from peg 2 to peg 1`
	`Move disc from peg 2 to peg 3`
`Hanoi(1, 1, 3)`	
	`Move disc from peg 1 to peg 3`

Stack contents: n, i, j

1st call : 3, 1, 3 □ SP

2nd call: 2, 1, 2 □SP
3, 1, 3

3rd call: 1, 1, 3 □ SP
2, 1, 2
3, 1, 3

4th call: 1, 3, 2 □ SP
2, 1, 2
3, 1, 3

5th call: 2, 2, 3 □ SP
3, 1, 3

(c)

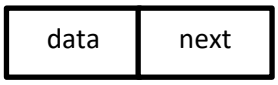
- variables take different values at each recursion

or

- these values must all be preserved for later recall.

7 (a)

Node Class Structure :




```
FUNCTION Delete(x, p)
      IF LENGTH(x)=0
            OUTPUT "List is EMPTY"
      ENDIF
      IF p=1      #case 1: delete 1st item
            currPtr ← Start
            Start ← currPtr.next
      ELSE  #case 2: delete in middle
            prevPtr ← null
            currPtr ← Start
            # find deletion point
            FOR n ← 1 to p-1
                  prevPtr ← currPtr
                  currPtr ← currPtr.next
            ENDFOR
            prevPtr.next ← currPtr.next

      ENDIF
ENDFUNCTION
```

```
FUNCTION Insert(x, item, p)
      prevPtr ← null
      currPtr ← Start
      new ← Node(item, null)

      IF p=1   #insert as 1st item
            new.next ← currPtr
            Start ← new
      ELSE     #insert anywhere
            FOR n ← 1 to p-1
                  prevPtr ← currPtr

                  currPtr ← currPtr.next
            ENDFOR
            new.next ← currPtr
            prevPtr.next ← new
      ENDIF
ENDFUNCTION
```

(b)

(i)
```
FUNCTION Create()
      Create(S)
ENDFUNCTION
```

(ii)
```
FUNCTION Push(item)
      Insert(S, item, 1)
ENDFUNCTION
```

(iii)
```
FUNCTION Pop() RETURNS STRING
      IF IsEmptyList(S)
      THEN
            RETURN ' '
      ELSE
            Temp  Read(S,1)
            DELETE(S,1)
            RETURN Temp
      ENDIF
ENDFUNCTION
```

(c)

Ii)
```
FUNCTION Undo() RETURNS STRING
      content = ''
      IF  undoStack.IsEmpty() = False
            content  undoStack.Pop()
            redoStack.Push(content)
      ENDIF
      RETURN content
ENDFUNCTION
```

(ii)
```
FUNCTION Redo() RETURNS STRING

      content =''
      IF redoStack.IsEmpty()= False
      content  redoStack.Pop()
            undoStack.Push(content)

      ENDIF
      RETURN content
ENDFUNCTION
```

8 (a)
(i)

3M: 3 tables with correct relationship and connectivities as shown above.

(ii)

Member (Member_ID, Name, Contact_No, Price)
Outlet(Outlet_ID, Outlet_Address)
ServiceRecord(Service_ID, Member_ID, Outlet_ID, Service_Date).

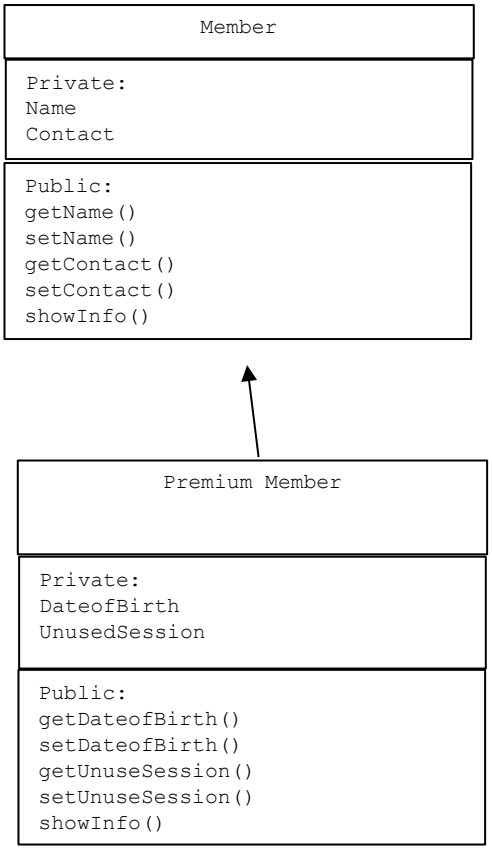
1M - Member + Member_ID as PK
1M – Outlet + Outlet_ID as PK
1M – ServiceRecord attributes as shown above
1M – ServiceRecord with Service_ID as PK
1M – ServiceRecord with Member_ID and Outlet_ID as FK

(b) The field "Service_Amount" should be added to the ServiceRecord table to capture the amount paid by the customer for each haircut service.

ServiceRecord(Service_ID, Member_ID, Outlet_ID, Service_Date, Service_Amount)
Member (Member_ID, Name, Contact_No)

1M – Add Service_Amount in ServiceRecord and remove Price from Member.

(c) (i)



1M – Arrow from subclass to superclass in diagram to indicate "member" class as superclass and "Premium Member" as subclass
1M – Polymorphism. Eg. showInfo()
2M – Member with private attributes and public methods
2M – Premium Member with private attributes and public methods

(ii) Encapsulation refers to the combining of data and functions into a single object. The Member class's attributes (Name, Contact) and methods (getName(), setName(), getContact(), setContact()) that operate on the attributes are bundled together in a class.

(iii)Polymorphism refers to an object's ability to take different forms. It allows subclasses to have methods with the same name as methods in their superclass. It gives the ability for a program to call the correct method depending on the type of object that is used to call it.

The method showInfo in the subclasses overrides the superclass showInfo. If the subclass object (PremiumMember) is used to call showInfo, then the subclass's version of the method is invoked. If the superclass object (Member) is used to call showInfo, then the superclass method will be invoked.

Web Applications	**Native Applications/Desktop Application**
Deployment and maintenance (updates) for a web-based application require deployment on a single set of server machines.	Deployment and any maintenance/patch are done on individual client machines separately.
Web applications can be accessed from anywhere (most locations), so there is no location constraint.	As desktop are confined to a standalone machine, so they can be only accessed from the machines they are deployed in.
Web applications are platform-independent, they can work in different types of platforms with the only requirement of a web browser.	Desktop applications need to be developed separately for different platform machines. (Windows, Linux, Unix, Mac etc)
Web applications are at higher security risks as they are inherently designed to increase accessibility.	Desktop applications, on the other hand, have better authorization and administrators have better control, hence more secure.
Web applications rely heavily on internet connectivity, for their operation.	Desktop applications don't require the internet for their operations. Some applications just require internet connectivity at the time of update.

(d) Any 2 differences

	(e) PDPA - any 2 Obligations 1. Consent Obligation - Only collect, use or disclose personal data when an individual has given his/her consent. 2.Purpose Limitation Obligation - An organisation may collect, use or disclose personal data about an individual for the purposes that a reasonable person would consider appropriate in the circumstances and for which the individual has given consent. 3.Notification Obligation - Notify individuals of the purposes for which your organisation is intending to collect, use or disclose their personal data on or before such collection, use or disclosure of personal data. 4. Access and Correction Obligation - Upon request, the personal data of an individual and information about the ways in which his or her personal data may have been used or disclosed in the past year should be provided. Organisations are also required to correct any error or omission in an individual's personal data upon his or her request. 5. Accuracy Obligation - Make reasonable effort to ensure that personal data collected by or on behalf of your organisation is accurate and complete, if it is likely to be used to make a decision that affects the individual, or if it is likely to be disclosed to another organisation. 6. Protection Obligation - Make security arrangements to protect the personal data that your organisation possesses or controls to prevent unauthorised access, collection, use, disclosure or similar risks. 7. Retention Limitation Obligation - Cease retention of personal data or remove the means by which the personal data can be associated with particular individuals when it is no longer necessary for any business or legal purpose. 8. Transfer Limitation Obligation -Transfer personal data to another country only according to the requirements prescribed under the regulations, to ensure that the standard of protection provided to the personal data so transferred will be comparable to the protection under the PDPA. 9. Accountability Obligation -Make information about your data protection policies, practices and complaints process available on request.