UNIVERSITY EXAMINATIONS

UNIVERSITEITSEKSAMENS

UNISA university of south africa

# COS1521 ( 497174) May/June 2016
# RCO1521 ( 497272)

## COMPUTER SYSTEMS: FUNDAMENTAL CONCEPTS

Duration : 2 Hours 100 Marks

**EXAMINERS :**
FIRST : MR ME BOGOPA
SECOND : MRS P LE ROUX

**Closed book examination.**



This paper consists of 27 pages and the instructions for the completion of a mark-reading sheet.

Please complete the attendance register on the back page, tear it off and hand it to the invigilator.

**Instructions:**

1. All the questions in this paper are **multiple-choice**.
2. There are 80 questions in total. Your total mark out of 80 will be converted to a final exam mark out of 100.
3. Answer all the questions. There is also space for rough work.
4. Using a pencil, answer all the questions on the mark-reading sheet.
5. Remember to fill in the **unique number** (see top of page) on the mark-reading sheet.
6. You are not allowed to use a calculator.

EVERYTHING OF THE BEST!

**This paper consists of 80 multiple-choice questions.**
**Each question is worth 1 mark.**
**Your total out of 80 will be converted to give a final exam mark out of 100.**

**Mark only one alternative per question with a pencil on the mark-reading sheet.**
***(Remember to fill in the unique number.)***

## Section A: Computer background, number systems, data storage, operations on data and logic (27 marks)

**QUESTION 1**
Which subsystem of a computer is responsible for the sending of signals to other subsystems?

1. Memory
2. Arithmetic logic unit
3. Control unit
4. Input/Output

**QUESTION 2**
Computer science has created some peripheral issues. Privacy, copyright and computer crime are categorized as _____ issues.

1. social
2. digital divide
3. security
4. ethical

**QUESTION 3**
Convert the decimal number $(75.55)_{10}$ to binary

1. $(101011.10001)_2$
2. $(101011.10010)_2$
3. $(101011.10000)_2$
4. $(101011.11000)_2$

**QUESTION 4**

Convert the binary number $(1101010.11)_2$ to hexadecimal

1. $(6A.3)_{16}$
2. $(6A.C)_{16}$
3. $(D4.3)_{16}$
4. $(D4.C)_{16}$

**QUESTION 5**

Convert $(8F.C)_{16}$ to an octal number:

1. $(117.3)_8$
2. $(79.6)_8$
3. $(117.6)_8$
4. $(79.3)_8$

**QUESTION 6**

What decimal integer is stored in memory (8 bits) as 110100010 in 2's complement representation?

1. -114
2. 114
3. -46
4. 46

Rough work:

**QUESTION 7**

Which one of the following statements regarding the storing of images is TRUE?

1. Raster graphics is used when we need to store a digital image.
2. The scanning rate in image processing is called resolutions.
3. A vector graphic image store bit patterns for each pixel.
4. Raster graphics decompose an image into a combination of geometrical shapes.

**QUESTION 8**

Convert $(101110101)_2$ to normalized form:

1. $(10111010)_2 \times (2^5)_{10}$
2. $(0101110101)_2 \times (2^6)_{10}$
3. $(101110101)_2 \times (2^3)_{10}$
4. $(0101110101)_2 \times (2^{-6})_{10}$

**QUESTION 9**

Calculate: (1011)2 XOR (1101)2.

1. $(0011)_2$
2. $(0110)_2$
3. $(0111)_2$
4. $(1001)_2$

**QUESTION 10**

A mask is used to unset bits of the bit pattern 10100110 (input). What is the output if the mask 00100100 is applied?

1. 01011001
2. 00100100
3. 10110101
4. 10100110

**QUESTION 11**

Calculate: $(1011.01)_2 + (111)_2$.

1. $(1101.00)_2$
2. $(10010.01)_2$
3. $(1101.01)_2$
4. $(10010.10)_2$

Rough work:

**QUESTION 12**

Calculate the simplest form of the Boolean function AB'C + (AB'C)'D ?

1. AB'C + D
2. A + B + C + D
3. D'
4. AB'C

**QUESTION 13**

Which of the examples below expresses the associative rule of Boolean algebra?

1. (x + y) + z = x + (y + z)
2. x(y + z) = xy + xz
3. x + (y + z) = xy + xz
4. x(yz) = (xy)z

**QUESTION 14**

Which Boolean rule represents the Boolean function x(x' + y) = xy?

1. Commutative rule
2. Distributive rule
3. Absorption rule
4. Identity rule

**QUESTION 15**

After applying DeMorgan's theorem to the expression [(A + B + C).D ]', the result is

1. A'B'C'D'
2. (ABC)'.D
3. ABC.D'
4. A'B'C' + D'

Rough work:

**QUESTION 16**

The following question refer to the incomplete truth table below for the expression

G = A'C + AB'

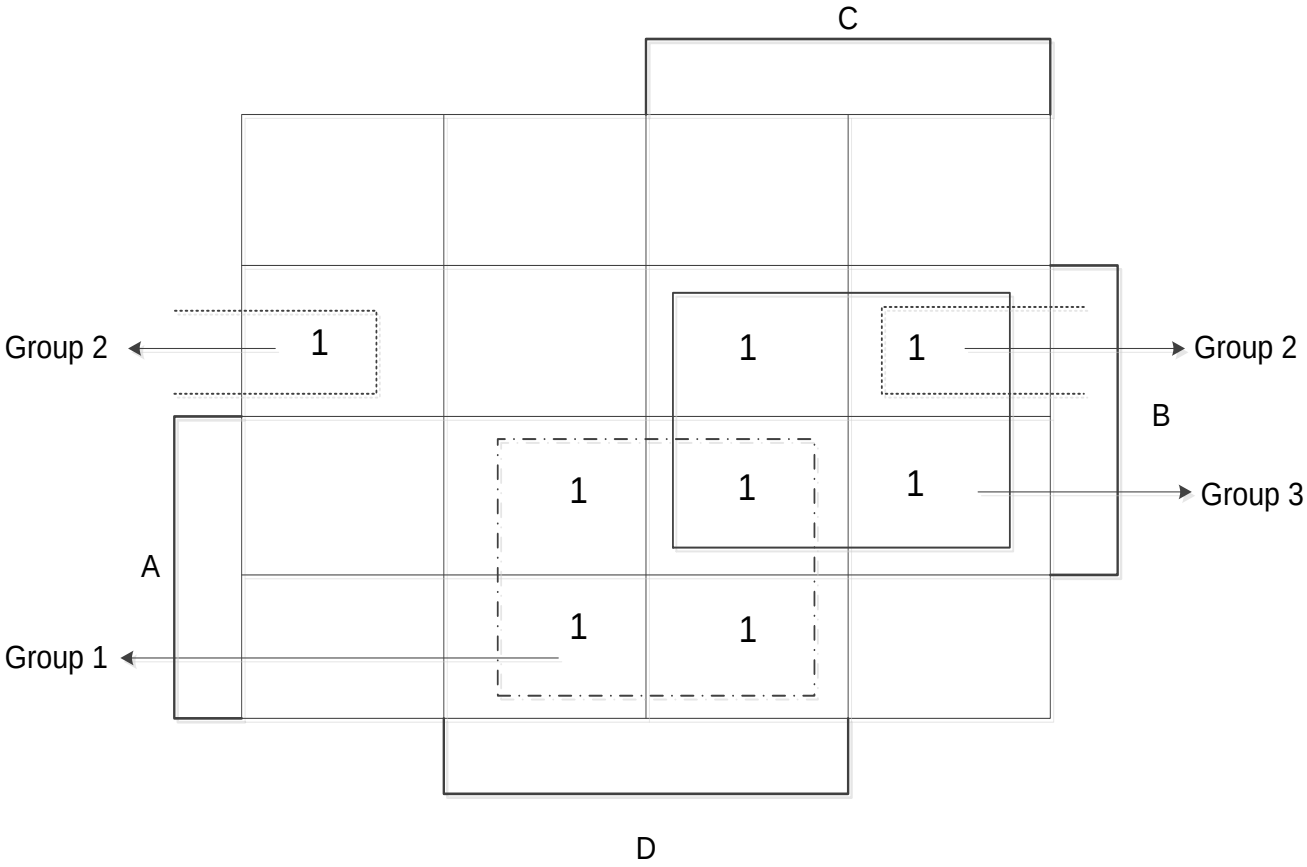
What is the expression G in sum of minterms form?

| A | B | C | G | minterms | m-notation |
|---|---|---|---|---|---|
| 0 | 0 | 0 | | | $m_0$ |
| 0 | 0 | 1 | 1 | | $m_1$ |
| | | | | A'BC' | |
| 0 | 1 | 1 | | | $m_3$ |
| 1 | 0 | 0 | | | |
| | | | | | |
| | | | | | |
| 1 | 1 | 1 | | | |

1. $m_3 + m_1 + m_5 + m_4$
2. $m_3 + m_1 + m_5 + m_6$
3. $m_2 + m_0 + m_6 + m_4$
4. $m_4 + m_2 + m_6 + m_2$

Rough work:

**The following TWO questions refer to the Karnaugh diagram below:**




**QUESTION 17**

Which term represents Group 2?

1. B
2. A'BD'
3. A'BC
4. BD’

**QUESTION 18**

Which term represents Group 3?

1. A'B
2. D'B
3. BC
4. CBD

**QUESTION 19**

Which of the Karnaugh diagrams below represents the expression $X = AC + BC + B$?

1.

| | B'C' | B'C | BC | BC' |
|---|---|---|---|---|
| A' | 1 | 1 | 1 | 1 |
| A | 0 | 0 | 0 | 0 |

2.

| | B'C' | B'C | BC | BC' |
|---|---|---|---|---|
| A' | 0 | 0 | 0 | 0 |
| A | 1 | 1 | 1 | 1 |

3.

| | B'C' | B'C | BC | BC' |
|---|---|---|---|---|
| A' | 0 | 0 | 1 | 1 |
| A | 0 | 1 | 1 | 1 |

4.

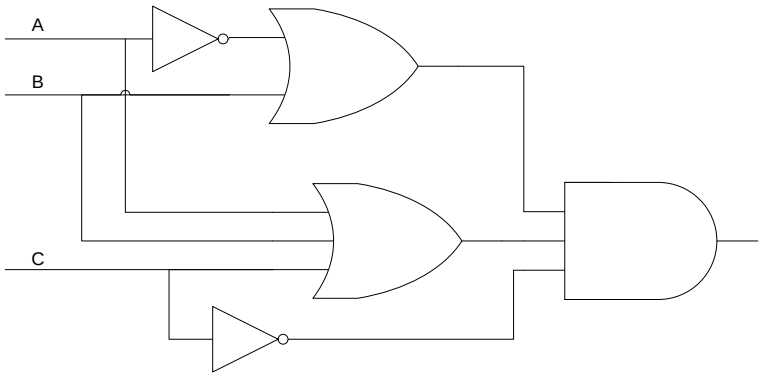
| | B'C' | B'C | BC | BC' |
|---|---|---|---|---|
| A' | 1 | 1 | 1 | 0 |
| A | 1 | 1 | 1 | 0 |

Rough work:

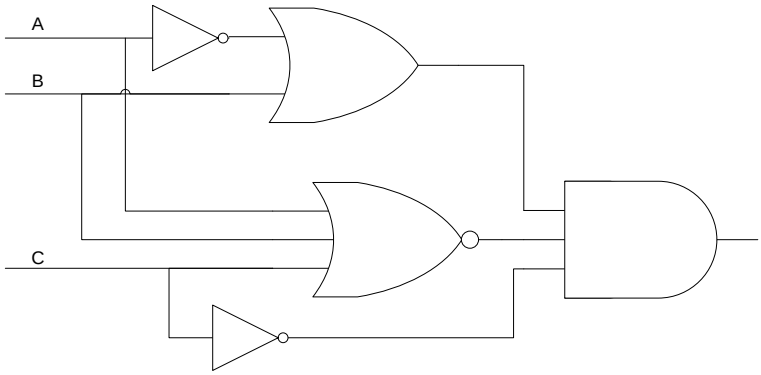
**QUESTION 20**

Which logic diagram presents the logic expression BC'?

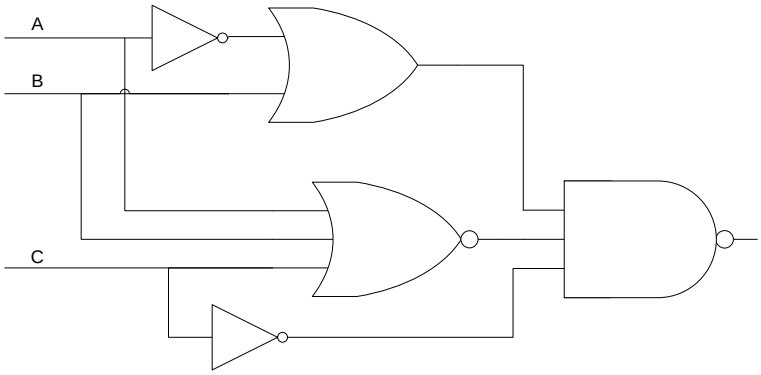
1.



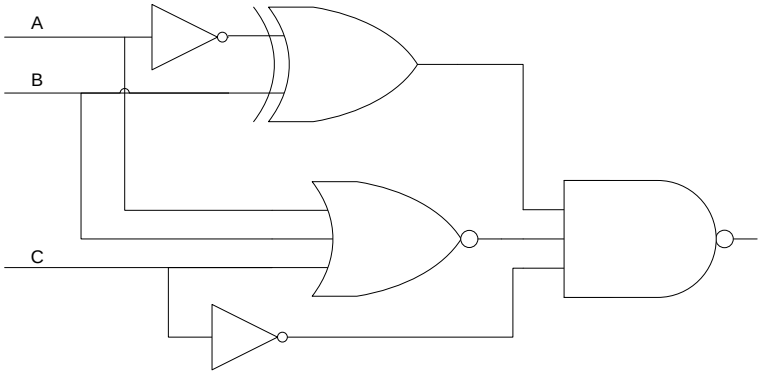

2.



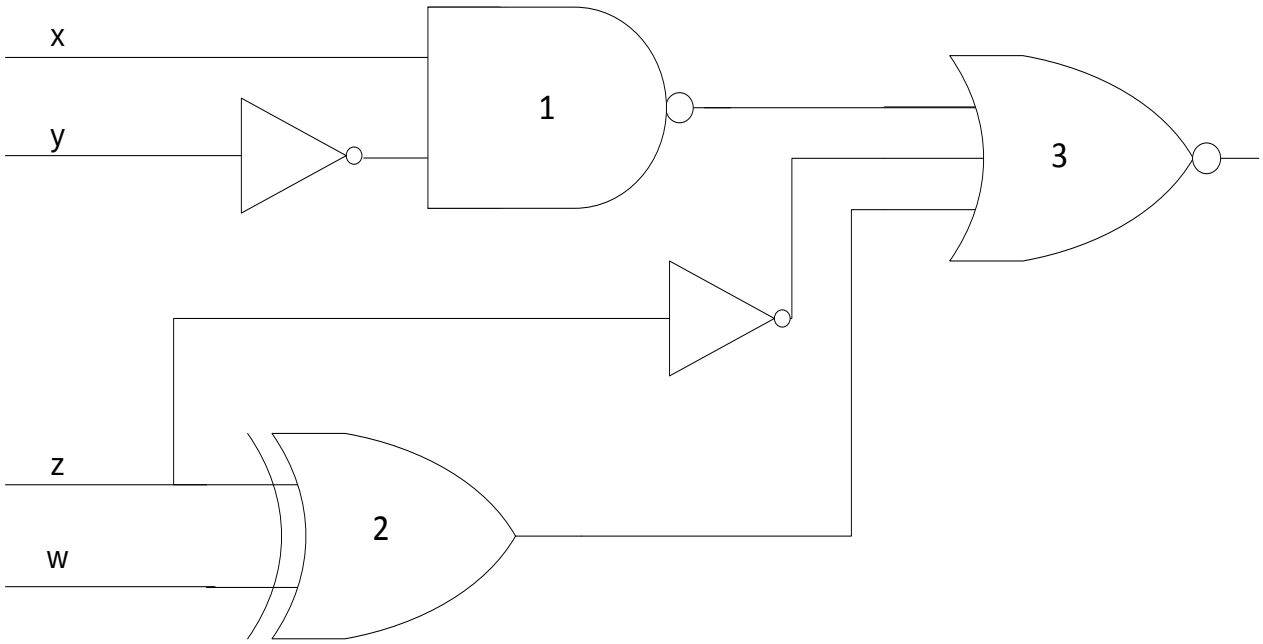

3.




4.



**Question 21, 22 and 23 refer to the following combinational logic circuit:**




**QUESTION 21**
Gate 2 is an example of a _____ gate.

1. AND
2. NAND
3. NOR
4. XOR

**QUESTION 22**
What is the output of Gate 2?

1. z' ⊕ w
2. z ⊕ w
3. z + w
4. zw' + z'w

**QUESTION 23**
What is the output of Gate 3?

1. [(x' + y) + z'(z + w)]'
2. (x + y') · (z' + zw' + 'wz)'
3. [(xy')' + z' + (z ⊕ w)]'
4. [(xy')' + z'(z' ⊕ w)]'

Rough work:

**The following FOUR questions refer to the following scenario:**

A safe has four locks *v, w, x,* and y. All four locks must be unlocked before the safe can be opened. The four keys are distributed amongst four people in the following way:

- Mr A has keys for locks *v* and *x*.
- Mr B has keys for locks *v* and *y*.
- Mr C has keys for locks *w* and *y*.
- Mr D has keys for locks *w* and *x*.

A Boolean function F(A,B,C,D) is defined as follows: F(A,B,C,D) = 1 when the safe can be opened, and a zero otherwise.

Different combinations inputs for A, B, C and D are given in the tables provided in the following FOUR questions. Which alternative shows the correct outputs for F in EACH of the following FOUR questions?

**QUESTION 24**

| | | | | Alternative 1 | Alternative 2 | Alternative 3 | Alternative 4 |
|---|---|---|---|---|---|---|---|
| **A** | **B** | **C** | **D** | **F** | **F** | **F** | **F** |
| 0 | 1 | 1 | 0 | 0 | 1 | 0 | 1 |
| 0 | 1 | 0 | 1 | 0 | 1 | 1 | 0 |

**QUESTION 25**

| | | | | Alternative 1 | Alternative 2 | Alternative 3 | Alternative 4 |
|---|---|---|---|---|---|---|---|
| **A** | **B** | **C** | **D** | **F** | **F** | **F** | **F** |
| 1 | 1 | 1 | 0 | 0 | 1 | 0 | 1 |
| 1 | 1 | 0 | 1 | 0 | 1 | 1 | 0 |

**QUESTION 26**

| | | | | Alternative 1 | Alternative 2 | Alternative 3 | Alternative 4 |
|---|---|---|---|---|---|---|---|
| **A** | **B** | **C** | **D** | **F** | **F** | **F** | **F** |
| 0 | 1 | 0 | 1 | 0 | 1 | 0 | 1 |
| 0 | 1 | 0 | 0 | 0 | 1 | 1 | 0 |

**QUESTION 27**

| | | | | Alternative 1 | Alternative 2 | Alternative 3 | Alternative 4 |
|---|---|---|---|---|---|---|---|
| **A** | **B** | **C** | **D** | **F** | **F** | **F** | **F** |
| 1 | 1 | 0 | 0 | 0 | 1 | 0 | 1 |
| 0 | 0 | 1 | 1 | 0 | 1 | 1 | 0 |

Rough work:

## Section B: Computer systems, organisation and networks (18 marks)

**QUESTION 28**

Which one of the following is among the three main operations performed by the arithmetic logic unit (ALU) of a computer?

1. Encode
2. Search
3. Scan
4. Shift

**QUESTION 29**

What is the task of the registers when the CPU needs to access a word in main memory?

1. Treat the input data as bit patterns
2. Facilitates the operations of the CPU
3. Controls the operation pf each subsystem
4. Shift bit patterns to the left or right

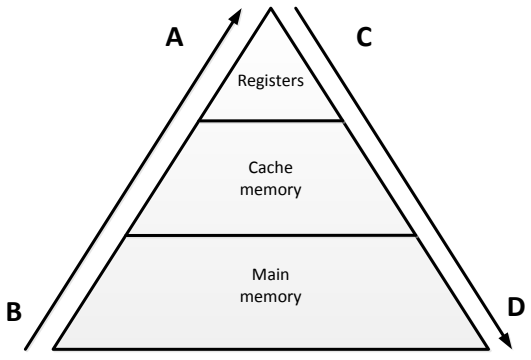
**QUESTION 30**

Which one of the following statements IS NOT TRUE about auxiliary storage devices?

1. They are volatile
2. They can be magnetic
3. They are considered to be I/O devices
4. They can be optical

**QUESTION 31**

In the following figure the hierarchical levels of memory are provided. The costliness (A and B) and speed (C and D) with regard to the memory hierarchy are indicated by the arrowed lines in the figure. Choose the alternative that gives the correct information for A, B, C and D.




| | | | | |
|---|---|---|---|---|
| 1. | A less costly, | B more costly, | C slowest, | D fastest |
| 2. | A more costly, | B less costly, | C fastest, | D slowest |
| 3. | A less costly, | B more costly, | C fastest, | D slowest |
| 4. | A more costly, | B less costly, | C slowest, | D fastest |

**QUESTION 32**

In the decode phase of the machine cycle, an instruction is an instruction register is decoded by the _____.

1. ALU
2. control unit
3. memory
4. programmed I/O

**QUESTION 33**

A computer has 1024 MB of memory. Each word in this computer has 64 bytes. How many bits are needed to address any single word in memory?

1. 25
2. 26
3. 23
4. 24

**QUESTION 34**

Pipelining can be defined as:

1. The simulation of complex instructions by using simple instructions.
2. Programming to be done in two levels: *microoperations* and *microprogramming*.
3. Processing of an instruction starts before another instruction is finished.
4. A single computer having multiple control units, multiple logic units and multiple memory units.

**QUESTION 35**

A host communicates with another host using the TCP/IP protocol. What is the unit of data send or received by the application layer?

1. message
2. datagram
3. frame
4. bytes

**QUESTION 36**

There are several layers in the Internet TCP/IP suite. What is the transport layer responsible for?

1. Node-to-node delivery of frames
2. Delivery of individual packets form the source host to the destination host
3. Providing services to the user
4. Logical delivery of a message between client and server processes

**QUESTION 37**

Which of the following is NOT a component of email architecture?

1. MTA server
2. MAA client
3. FTP protocol
4. UA program

**QUESTION 38**
A computer that translates _____ of another computer into a(n) _____ and vice versa, upon request is known as DNS server.

1. Domain name and IP address
2. Host address and Domain name
3. Domain name and server address
4. Server name and IP address

**QUESTION 39**
What are the identifiers needed to define a webpage?

1. protocol, client, port, path
2. protocol, host, browser, path
3. protocol, host port, path
4. protocol, client, server, path

**QUESTION 40**
In _____ only one program can reside in memory for execution.

1. monoprogramming
2. multiprogramming
3. partitioning
4. paging

**QUESTION 41**
In paging, a memory is divided into equally sized sections called _____.

1. pages
2. frames
3. segments
4. partitions

**QUESTION 42**
Which two of the following techniques belongs to the *swapping* category?

A. Paging
B. Segmentation
C. Demand paging
D. Demand segmentation
E. Partitioning

1. A and B
2. B and C
3. C and D
4. D and E.

**QUESTION 43**

A process in the ready state goes to the running state when _____.

1. it enters memory
2. it requests
3. it gets access to the CPU
4. it finishes running

**QUESTION 44**

The operating system synchronises different processes with different resources but a deadlock can occur. There are four necessary conditions for a deadlock to occur. Which of the following is the correct description of the 'NO PREEMPTION' condition?

1. The operating system cannot temporarily relocate a resource.
2. Only one process can hold a resource.
3. A process holds a resource even though it cannot use it until other resources are available.
4. All processes and resources involved form a loop.

**QUESTION 45**

Which ONE of the following managers is responsible for archiving and backup?

1. memory
2. process
3. device
4. file

## Section C: Computer algorithms, programming and software development

**(18 marks)**

**QUESTION 46**

A list contains the following elements:

7 10 17 19 35 40 48 69 76 81 83 98 110

At the beginning, first = 1, mid = 7 and last = 13. What are the values of first, mid and last respectively after two more iterations of the binary search algorithm if the goal is 35?

1. 1, 3, 6
2. 2, 5, 8
3. 4, 5, 6
4. 7, 10, 13

**QUESTION 47**

Suppose a list contains the following elements:

55 71 16 33 65 48 83 24

What is the order of the elements in the list after three passes if selection sort is used?

1. 16 24 33 55 65 48 83 71
2. 16 71 55 33 65 48 83 24
3. 16 24 55 33 65 48 83 71
4. 16 24 33 55 48 65 71 83

Rough work:

**QUESTION 48**

In which Sorting algorithms is the list to be sorted divided in to two sublists – sorted and unsorted, and separated by an imaginary wall?

1. Selection sort
2. Bubble sort
3. Insertion sort
4. Deletion sort

**QUESTION 49**

Which construct is represented by the below Pseudocode?

*get our number*
*set our initial count to 0*
***while*** *our number is greater than 1*
*divide the number 2*
*increase our count by 1*
***end***

1. Sequence
2. Decision
3. Repetition
4. Generalization

**QUESTION 50**

The way a card game player arranges his cards as he picks them up one by one, is an example of?

1. Bubble sort
2. Selection sort
3. Insertion sort
4. Merge sort

**QUESTION 51**

Which one of the following is a logical parts of the 'Summation' algorithm?

1. Swap the selection algorithm.
2. Initialization of the product at the beginning.
3. The loop, which in each iteration multiplies a new integer with the product.
4. Return of the result after exiting from the loop.

**QUESTION 52**

Which language was understood by the computer hardware, and the language was made of electronic switches with two states?

1. Computer language
2. High-level language
3. Assembly language
4. Machine language

**QUESTION 53**

(i) _____and (ii) _____ are both classified as object-oriented languages

1. (i) BASIC (ii) C#
2. (i) Java (ii) C
3. (i) C (ii) Visual Basic
4. (i) C++ (ii) C#

**QUESTION 54**

During the source code translation process, the source file goes through a series of sub-processes to its final output. In which sub-process a set of tokens are parses to find instructions?

1. syntax analysis
2. lexical analysis
3. code generation
4. semantic analysis

**QUESTION 55**

What is the tool used by a programmer to convert a source program into the object program?

1. Compiler
2. Language translator
3. Linker
4. Preprocessor

**QUESTION 56**

Which computer programming language is known for using *prolog*?

1. Declarative
2. Functional
3. Procedural
4. Object-oriented

**QUESTION 57**

Which one is a common language in the business environment?

1. FORTRAN
2. C++
3. C
4. COBOL

**QUESTION 58**

State whether True or False for the Incremental model.

A. Software is developed in a series of steps.
B. They do not add more functionality until the existing system works properly.

1. False, False
2. False, True
3. True, False
4. True, True

**QUESTION 59**

Coupling is _____.

1. the encapsulation of data and methods.
2. the division of a large program into smaller parts that can communicate with each other.
3. a measure of how tightly two modules are bound to each other.
4. a measure of how closely the modules in a system are related.

**QUESTION 60**

Transferability is one of the measures for software quality. Transferability includes _____.

1. portability
2. changeability
3. flexibility
4. efficiency

**QUESTION 61**

_____ is a black box testing method?

1. Boundary value testing
2. Basic path testing
3. Code path testing
4. Control stricture testing

**QUESTION 62**
The objective of testing phase is?

1. to debug software
2. to uncover errors
3. to gain modularity
4. to analyse system

**QUESTION 63**
Documentation is needed in order to use software properly and maintain it efficiently. Technical documentation _____.

1. describes the installation and the servicing of the software system.
2. defines the software itself.
3. can be a very powerful marketing tool.
4. shows how to use the software step by step.

## Section D: Computer data and files structure, and databases (17 marks)

**QUESTION 64**
All the members of a record must be _____.

1. the same type
2. related type
3. integer type
4. character type

**QUESTION 65**
Which of the following best describes what a linked list is?

1. A collection of fields that are all related to one object.
2. A sequenced collection of elements, normally of the same data type.
3. A collection of related elements, possible of different types.
4. A collection of data in which each element contains the location of the next element.

**QUESTION 66**
Which of the following operations can be defined on array structures?

A. Searching
B. Deletion
C. Retrieval
D. Insertion

Alternatives:
1. Only A, B and C
2. Only B, C and D
3. Only A, B and D
4. A, B, C, and D.

**QUESTION 67**
Given a linked list called children, the pointer variable children identifies _____ element of the linked list..

1. first
2. second
3. middle
4. last

**QUESTION 68**
What is an ordered collection of data in which each element contains the location of the next element?

1. An array
2. A record
3. A linked list
4. A node

**QUESTION 69**
State whether the below two statements are True or False regarding retrieving elements.

A. Retrieving means randomly accessing an element for the purpose of inspecting or copying the data contained in the element.
B. Retrieving is a difficult operation when a data structure is an array.

1. False, False
2. False, True
3. True, False
4. True, True

**QUESTION 70**
When a sequential file is updated, which file contains the changes to be applied?

1. new master
2. old master
3. transaction
4. error report

**QUESTION 71**

What is the address produced by a hashing algorithm?

1. probe
2. synonym
3. collision
4. home

**QUESTION 72**

How many field(s) does the index of an indexed file has?

1. one
2. two
3. three
4. four

**QUESTION 73**

When using digit extraction hashing, selected digits are extracted from the key and used as _____

1. the buckets
2. the address
3. the record
4. the report

**QUESTION 74**

Which one of the following steps is NOT correct when accessing a record in the file?

1. The entire index file is loaded into main memory.
2. The index entries are searched, using an efficient search algorithm such as a binary search, to find the desired key.
3. The address of the record is retrieved.
4. Using the address, the data record is retrieved and passed to the mapping.

**QUESTION 75**

The data model and the schema of a DBMS are often defined at the _____level

1. physical
2. internal
3. conceptual
4. external

**QUESTION 76**

In the _____ model, the entities are organised in a graph, in which some entities can be accessed through several paths.

1. Network
2. Distributed
3. Relational
4. Hierarchical

**QUESTION 77**

What name is given to a column of relation (table)?

1. Attribute
2. Tuple
3. Field
4. Cardinality

**QUESTION 78**

A binary operator is applied to _____ relations(s) and creates an output of_____relation(s).

1. one, one
2. one, two
3. two, one
4. two, two

**QUESTION 79**

In a replicated distributed database, _____.

1. data are localised
2. objects and their relations are defined
3. each site holds an exact duplication of another site
4. any modification to data stored in one site is repeated exactly at every site

**QUESTION 80**

Which of the following is a declarative language used on relational databases?

1. PDQ
2. SQL
3. LES
4. PBJ