higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

NATIONAL CERTIFICATE (VOCATIONAL)

PRINCIPLES OF COMPUTER PROGRAMMING

(First paper)
NQF LEVEL 3

(10041023)

18 November 2024 (X-paper)
09:00–11:00

This question paper consists of 11 pages.

247Q1N2418

Copyright reserved

DEPARTMENT OF HIGHER EDUCATION AND TRAINING
REPUBLIC OF SOUTH AFRICA

NATIONAL CERTIFICATE (VOCATIONAL)
PRINCIPLES OF COMPUTER PROGRAMMING
(First paper)
NQF LEVEL 3
TIME: 2 HOURS
MARKS: 100

INSTRUCTIONS AND INFORMATION

1. Answer all the questions.
2. Read all the questions carefully.
3. Number the answers according to the numbering system used in this question paper.
4. Start each section on a new page.
5. Use only a black or blue pen.
6. Write neatly and legibly.

Copyright reserved

SECTION A

QUESTION 1

Various options are given as possible answers to the following questions. Choose the answer and write only the letter (A–D) next to the question number (1.1–1.10) in the ANSWER BOOK.

1.1 What is the primary purpose of a logical data type in programming?

A To do complex mathematical calculations.
B To store numbers with a decimal point.
C To store data that are either represented by a true or false value.
D To store text, numeric and alphanumeric data.

1.2 Which of the following options best describes the main concept of event-driven programming?

A Writing code that is executed in a sequential or step-by-step manner.
B Creating functions that perform complex mathematical calculations.
C Designing programs that respond to user actions.
D Optimising code for maximum efficiency and speed.

1.3 Which data structure in VB.NET allows one to store elements in a way that can be accessed using an index and can dynamically resize as elements are added or removed?

A Array
B Stack
C Queue
D LinkedList

1.4 Which type of input error is related to the incorrect sequence or structure of the code, causing the program not to compile?

A Syntax Error
B Logical Error
C Runtime Error
D Semantic Error

1.5 In Microsoft Access, what type of key uniquely identifies each record in a table and ensures that the values are unique and non-null?

A Super key
B Primary key
C Foreign key
D Index key

Copyright reserved

1.6 Which of the following options represent a method in MS Access that is used to retrieve specific data from a database table based on specified criteria?

A Index
B Schema
C Trigger
D Query

1.7 The snippet of code below,

```
1  Dim userInput As String = "abc123"
2  Dim numericValue As Integer
3
4      numericValue = Integer.Parse(userInput)
```

represents an example of a …

A overflow error.
B underflow error.
C format exception.
D syntax error.

1.8 Which VB.NET function is used to concatenate multiple strings together into a single string?

A `MergeString()`
B `Combine()`
C `JoinStrings()`
D `Concat()`

1.9 Which format specifier in VB.NET is used to display a numeric value with a fixed number of decimal places?

A `TicketPrice.ToString('F')`
B `TicketPrice.ToString('C')`
C `TicketPrice.ToString('D')`
D `TicketPrice.ToString('E')`

1.10 Which of the following options best describes pseudocode?

A A formal programming language used with VB.NET.
B A visual representation of the program's logic.
C A type of error that occurs during program execution.
D A step-by-step human readable description of an algorithm.

(10 × 1) **[10]**

QUESTION 2

Indicate whether the following statements are TRUE or FALSE by writing only 'True' or 'False' next to the question number (2.1–2.5) in the ANSWER BOOK.

2.1 In a flowchart, a diamond shape is commonly used to represent a decision or conditional statement.

2.2 Flowcharts can be used to represent complex processes and decision-making logic in a visual and easy-to-understand format.

2.3 In VB.NET, arrays must always be initialised with a fixed size, and the number of elements cannot be changed once the array is declared.

2.4 A syntax error in VB.NET will always result in a runtime error when the program is executed.

2.5 The `WHERE` clause in a SQL query is used to filter rows based on specific conditions, allowing one to retrieve only the data that meets those conditions.

(5 × 1) **[5]**

QUESTION 3

Choose an item from COLUMN B that matches a description in COLUMN A. Write only the letter (A–J) next to the question number (3.1–3.5) in the ANSWER BOOK.

COLUMN A		COLUMN B	
3.1	A set of saved instructions for retrieving specific data from a database	A	criteria
3.2	A method for specifying complex patterns for text and expression matching and validation	B	input mask
3.3	A search algorithm that operates by visiting all elements one by one until the desired element is found	C	regex
3.4	A control that allows the user to select one option from a group	D	linear search
3.5	A flowchart symbol used to represent arithmetic operations and data-manipulations	E	query
		F	binary search
		G	group box
		H	radio button
		I	parallelogram
		J	rectangle

(5 × 1) **[5]**

TOTAL SECTION A: 20

Copyright reserved

SECTION B

QUESTION 4

4.1 Construct a complete truth table for the Boolean expression,

(A XOR B) AND (C OR D)

including all possible combinations of the variables A, B, C, and D.

Provide the values of the expression for each combination and the final result. (5)

4.2 Convert the hexadecimal number, 1A3, to its decimal equivalent. (4)

4.3 Draw the standard symbol to represent an XOR (exclusive OR) gate. (1)

[10]

QUESTION 5

Study the information below and answer the questions that follow:

An NCV level 2 student created a VB.NET application that can be used to determine the letter grading of a student's test mark. The student created a specific criterion that will determine which letter grade is assigned to a certain mark as shown in TABLE 1.

Letter grade	Grade mark criteria
A+	90% or higher
A	85% – 89%
A-	80% – 84%
B+	75% – 79%
B	70% – 74%
C	60% – 69%
D	50% – 59%
E	Below 50% (Fail)

TABLE 1: MARK GRADING CRITERIA

After creating the table above, she/he proceeded to create the user interface for the VB.NET application as shown in FIGURE 1 below.

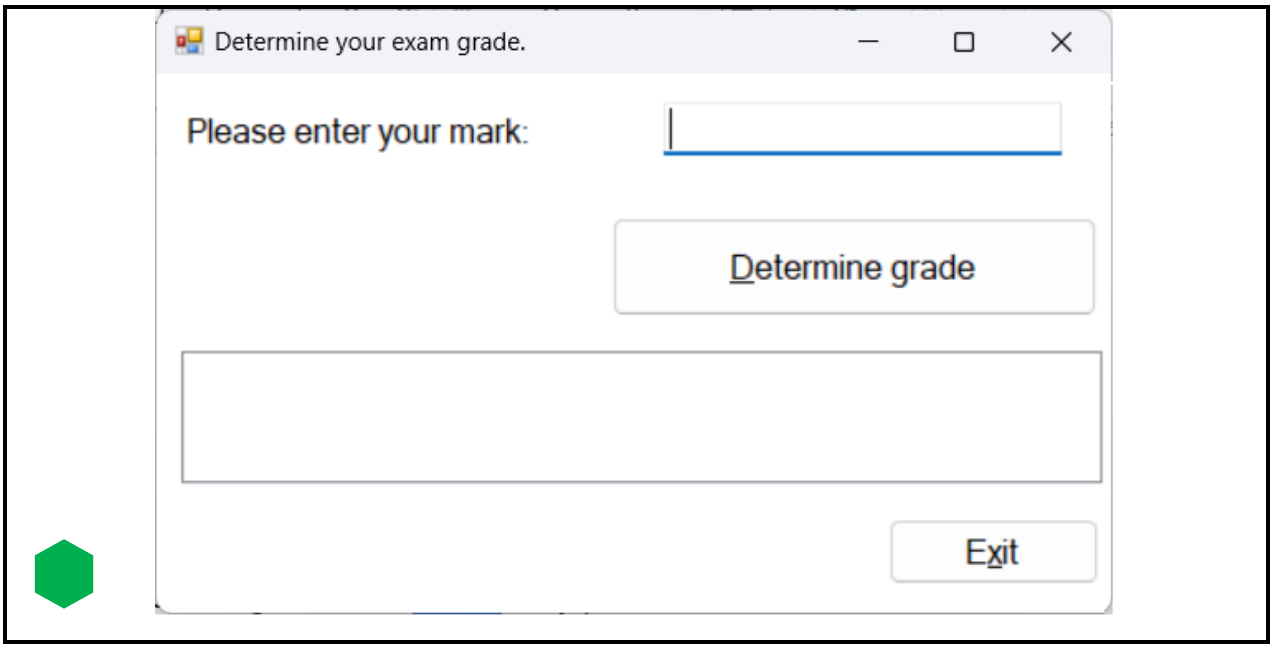

FIGURE 1: EXAMPLE INTERFACE

5.1 Briefly explain the use of IPO diagrams, flowcharts and pseudocode in software development. (1 × 2) (2)

5.2 Create an IPO diagram to represent the algorithm that can be used for the above application. (6)

5.3 Create appropriate pseudocode to describe how the algorithm would work.

NOTE: The pseudocode will be assessed against its completeness, correctness and the use of pseudocode conventions. (6)

5.4 Design a flowchart that illustrates the algorithm for the test mark grading application. The flowchart should depict the process of determining letter grades based on students' test marks visually. (8)

[22]

QUESTION 6

6.1 Visual Basic.NET provides a data structure called an array. An array is a collection of elements, each of which is of the same data type and organised under a single variable name. Arrays allow one to store and manipulate multiple values of the same type efficiently. One can think of an array as a container that holds a fixed number of items, and each item is accessed by an index (position) within the array.

The following VB.NET code snippet contains the declaration statement of an array. The array is of the string datatype and has been initialised with some values.

```
Dim strArrNames() as String = {'Alice', 'Fanafuthi',
'Thabiso', 'James', 'Thandi', 'Mike'}
```

6.1.1 Identify the maximum subscript value of the array *strArrNames*. (1)

6.1.2 Substantiate your answer to QUESTION 6.1.1 by giving TWO reasons. (2 × 1) (2)

6.1.3 Suppose that the programmer wanted to change the value of one of the elements of the array called *strArrNames*.

Write the VB.NET code that will change the value of 'Thandi' to 'Thandeka'. (3 × 1) (3)

6.1.4 Identify TWO VB.NET keywords that are used to change the size of an array while maintaining the current value of all the elements. (2)

6.1.5 Explain the purpose of the *Array.Sort()* method in VB.NET. (2 × 2) (4)

6.2 Study the following code snippet and answer the questions that follow:

```
1 Try
2   ' some code
3 Finally
4   ' some other code
5 End Try
```

6.2.1 Identify the programming concept illustrated in the above lines of code. (1)

6.2.2 Explain the purpose why programmers use `Try/ Catch` in programming. (2 × 2) (4)

6.2.3 Which of the following will be the result from compiling the code shown above?

A The code will generate an error because there is no `Catch` block.
B The code will generate an error because there is no `Throw` statement.
C The code will compile without any errors.
D The code will generate an error because the `Finally` block is before the `End Try` statement. (1)

6.3 A bubble-sort algorithm is a simple sorting algorithm that repeatedly steps through a list, compares adjacent elements, and swaps them if they are in the wrong order.

Study the following snippet of code and answer the questions that follow.

```
1 Dim intArrNumbers() As Integer = {64, 34, 25, 12, 22, 11,90}
```

6.3.1 Fill in the blank array elements to show the steps involved in applying the bubble-sort algorithm to the array *intArrNumbers*.

	64	**34**	**25**	**12**	**22**	**11**	**90**
(a)							
(b)							
(c)							
(d)							
(e)							
	11	**12**	**22**	**25**	**34**	**64**	**90**

NOTE: You only need to show the missing steps where a change is applied to the array.

Complete the above table of the array elements by writing only the answers next to the question number (6.3.1(a)–6.3.1(e)) in the ANSWER BOOK. (5 × 1) (5)

6.3.2 State THREE other sorting algorithms other than *Bubble Sort*. (3)

6.3.3 Identify ONE *manual* debugging technique that a programmer can use to debug a bubble-sort algorithm. (1)

[27]

QUESTION 7

Read the following text and answer the questions that follow.

In a database management system (DBMS), keys play a crucial role in maintaining data integrity and facilitating efficient data retrieval.

7.1 Choose an item from COLUMN B that matches a description in COLUMN A. Write only the letter (A–H) next to the question number (7.1.1–7.1.8) in the ANSWER BOOK.

COLUMN A		COLUMN B	
7.1.1	A group of single or multiple keys that identifies rows in a table	A	surrogate key
7.1.2	A column or group of columns that uniquely identifies every row in a table	B	composite key
7.1.3	A set of attributes that uniquely identify tuples in a table with no repeated attributes	C	candidate key
7.1.4	A column or group of columns that uniquely identifies every row in a table but not chosen as the primary key	D	alternate key
7.1.5	A column that creates a relationship between two tables to maintain data integrity	E	compound key
7.1.6	A key with two or more attributes where individual columns may not be unique by themselves	F	foreign key
7.1.7	A combination of columns that guarantees uniqueness but doesn't guarantee individual uniqueness	G	primary key
7.1.8	An artificial key created when no natural primary key exists	H	super key

(8 × 1) (8)

7.2 Study the description and diagram (FIGURE 2) below and answer the questions that follow.

The diagram below (FIGURE 2) represents database tables that have been normalised. Database tables are normalised to improve data integrity, minimize data redundancy, and enhance database efficiency.

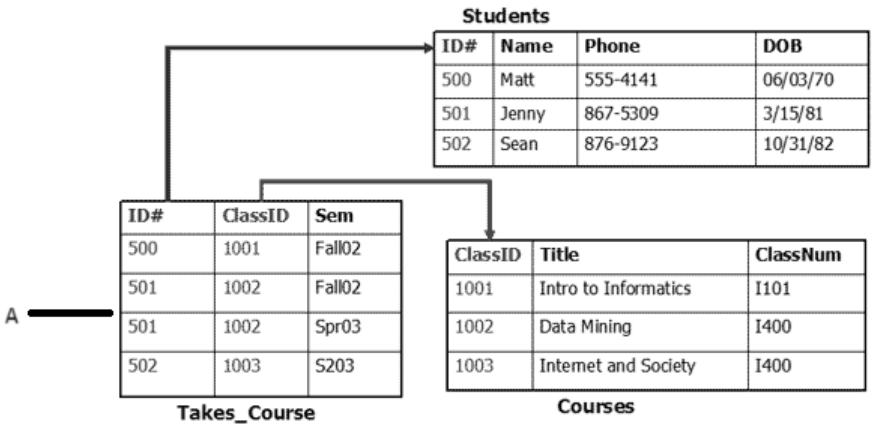

FIGURE 2: DATABASE TABLES

7.2.1 Identify the type of entity/table represented by the label A. (1 × 2) (2)

7.2.2 Explain the purpose of the type of entity identified in QUESTION 7.2.1. (2 × 2) (4)

7.2.3 Define the term, *foreign key*. (2)

7.2.4 Identify the names of the foreign keys in the *Takes_Course* table. (2)

7.2.5 State the name of the SQL command clause that will combine the records from TWO or more tables in a database. (1)

7.2.6 Explain the concept of *database normalisation* and its importance in database design. (2 × 1) (2)

[21]

TOTAL SECTION B: 80
GRAND TOTAL: 100

Copyright reserved