higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

NATIONAL CERTIFICATE (VOCATIONAL)

INTRODUCTION TO TECHNICAL PROGRAMMING

NQF LEVEL 3

(First paper)

(10041063)

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09:00–12:00

This question paper consists of 13 pages.

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DEPARTMENT OF HIGHER EDUCATION AND TRAINING
REPUBLIC OF SOUTH AFRICA

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INTRODUCTION TO TECHNICAL PROGRAMMING
NQF LEVEL3
(First paper)
TIME: 3 HOURS
MARKS: 120

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. Use only a black or blue pen.
5. Diagrams should be clear and neat and may be done in pencil.
6. Write neatly and legibly.

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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 … memory is found in smartphones, SSDs and memory sticks.

A Cache
B Flash
C Virtual
D CMOS

1.2 Which type of structure do all programs use?

A Sequence
B Iteration
C Repetition
D Loop

1.3 Which ONE of the following is a set of step-by-step instructions that accomplish a task?

A Algorithm
B Mnemonic
C Heuristic
D Loop

1.4 Which ONE of the following best describes a memory location whose value can change during runtime?

A Keyword
B Statement
C Variable
D Constant

1.5 On the Arduino board, the … pin acts as a pin with zero voltage.

A Vin
B GND
C RESET
D 5V

1.6 When using mBlock, where will you find the command, **say Hello** ?

A Motion
B Looks
C Sound
D Sensing

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1.7 The Linux command …, is used to create an empty file.

A touch
B rmdir
C mkdir
D clear

1.8 In mBlock, we use the … category to add repetition structures to the program.

A motion
B events
C control
D sensing

1.9 In flowcharts, the decision symbol is a …

A Rectangle.
B triangle.
C diamond.
D circle.

1.10 Placing a control structure within another structure is called …

A Tangling.
B nesting.
C stacking.
D joining.

(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 Debugging is the process of always fixing errors on the first try.

2.2 A selection structure is also referred to as an iteration.

2.3 Pseudocode is a diagrammatic solution to a problem.

2.4 A user story is a tool used in the problem analysis phase of the PDLC.

2.5 Decomposition is the process of breaking down a complex or large problem into smaller, manageable parts.

(5 × 1) **[5]**

QUESTION 3

Choose a term from COLUMN B that matches a description in COLUMN A. Write only the letter (A–M) next to the question number (3.1–3.10) in the ANSWER BOOK.

COLUMN A		COLUMN B	
3.1	Software developed to run in web browsers and does not require any installation	A	pattern recognition
3.2	The study of people's physical comfort, safety and efficiency in their workplace	B	application software
3.3	Software that controls and maintains the operations of a computer and its devices	C	abstraction
3.4	A computer program that translates computer source code from a high-level language into a low-level language	D	compiler
3.5	Permanent software embedded in the computer system's ROM	E	IDE
3.6	A software tool used to create programs in a particular programming language	F	freeware
3.7	Copyrighted software that must be purchased	G	proprietary software
3.8	Software that can be downloaded and used for free, but the rights to the software still belong to the creator	H	system software
3.9	Identifying similarities among problems that you previously solved	I	firmware
3.10	Identifying and concentrating on the important and generic information only	J	decomposition
		K	online software
		L	open source
		M	ergonomics

(10 × 1) **[10]**

QUESTION 4

Complete the following sentences by filling in the missing word or words next to the question number (4.1–4.5) in the ANSWER BOOK.

4.1 (RAM/ROM) stores instructions needed by the computer to start up.

4.2 The Linux command to rename a file is (mv/rm).

4.3 The cin object is typically used with the (insertion/extraction) operator.

4.4 A (compiler/interpreter) directly executes a program instruction by translating source code one line at a time.

4.5 The Git (commit/checkout) command is used to save your changes to the repository.

(5 × 1) **[5]**

TOTAL SECTION A: 30

SECTION B

QUESTION 5

5.1 Define each of the following terms/concepts.

5.1.1 Motherboard

5.1.2 Cache memory

5.1.3 Microcontroller

5.1.4 Microprocessor

5.1.5 CPU

(5 × 2) (10)

5.2 List any TWO advantages of using online software. (2)

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5.3 Look at the scenario below and answer the questions that follow:



The Linux operating system has a shell with a CLI, that is similar to the Windows Command Prompt. Linux commands can be typed into the shell and then executed.

5.3.1 Expand the acronym CLI. (1)

5.3.2 Write the Linux command to find out more about how the list directory command works. (1)

5.3.3 Write the Linux command to create a new folder called **Assessments** in the current directory. (1)

5.3.4 Write the Linux command to rename a file called **Test1.docx** to **Assignment1.docx**. (1)

[16]

QUESTION 6



6.1 Study the scenario below and answer the questions that follow:

Mzansi TVET College requires your assistance in creating an application to calculate and display their students' fees. The user must input the fee for each of the seven subjects. The application must then determine and display:

- *The subtotal of the fees*
- *VAT at 15%*
- *Total fees owing by the student, VAT inclusive.*

6.1.1 Draw the IPO chart for the problem above. (6)

6.1.2 Draw a corresponding flow chart to represent a potential solution. (7)

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



```
int x = 10;
int y = 5;
bool result = (x > y) && (y != 0);
```

6.2.1 Determine what value will be stored in the variable result. Show your reasoning (4)

6.2.2 What will the value of result be if the && is changed to an **||** (1)

6.2.3 List TWO other integer datatypes that can be used in C++ (2)

[20]

QUESTION 7

7.1 Is C++ a compiled or interpreted language? (1)

7.2 Study the code snippet below and answer the questions that follow:

```
1   #include <iostream>
2   using namespace std;
3   int main()
4    {
5      float cost_price, selling_price;
6      float VAT = 0.15;
7      cout << "Enter the cost price" << endl;
8      cin >> cost_price;
9      selling_price = cost_price – (cost_price * VAT);
10     cout << "Selling price is " << selling_price;
11     return 0;
12   }
```

7.2.1 Define the term *debugging.* (2)

7.2.2 Differentiate between *Syntax* and *Logic errors.* (2)

7.2.3 The above code contains an error. Identify the Line number and indicate if it is a Syntax or Logic error. (2)

7.2.4 Provide the corrected line of code. (1)

7.3 Study the following partial code snippet of a program and complete the code as required based on the instructions that follow.

```
#include <iostream>
using namespace std;

int main() {
    int answer;
    bool valid_input = false;
    while (!valid_input) {

       // missing code to be included here

    } // end while
    return 0;
}
```

7.3.1 Complete the C++ program that validates user input according to the following requirements: (7)

- Prompt the user to enter a number with the message "Enter a number: "
- Accept only integer inputs between 0 and 55 (inclusive).
- For valid input, display "Valid input" and end the program.
- For invalid input, display "Invalid input. Please enter a number between 0 and 55."
- Continue asking for input until a valid number is entered.

7.3.2 What is the purpose of the `return 0;` statement as part of the program? (1)

[16]

QUESTION 8

8.1 Study the following C++ program and answer the questions that follow:

```
1   #include <iostream>
2   using namespace std;

3   void display();
4   float volumeFunc();
5   float r, h, volume;

6   int main()
7   {
8       cout << "Enter the radius of the cylinder: " << endl;
9       cin >> r;
10      cout << "Enter the height: " << endl;
11      cin >> h;

12      display();
13      return 0;
14  }

15  float volumeFunc()
16  {
17      return (3.14 * r * r);
18  }

19  void display()
20  {
21      volume = volumeFunc();
22      cout << "The volume is " << volume << endl;
23  }
```

8.1.1 Identify the scope of the variables in the program above. (1)

8.1.2 Briefly explain the purpose of creating user-defined functions in programming. (2)

8.1.3 Define the term *function prototype.* (2)

8.1.4 Identify ONE line of code where a function prototype is created. Write only the line number in your answer. (1)

8.1.5 Briefly explain what is happening in line 21 in the program above. (2)

8.2 Write a complete C++ program to generate and print 10 random numbers below each other on the screen. The random number generated must be between 10 and 30 inclusive and should be assigned to the variable n before being printed. A random number may be printed more than once. (7)

Your friend also attempted the program in Python and presented you with the following screenshot.

```
1  import random
2
3  # Seed the random number generator
4  random.seed()
5
6  for i in range(10):
7      # Generate random number between 10 and 30 (inclusive)
8      n = random.randint(10, 30)
9      print(n)
```

Shell

```
>>> %Run -c $EDITOR_CONTENT
 24
 16
 24
 29
 29
 11
 10
 21
 28
 21
```

[15]

QUESTION 9

9.1 Study the following C++ program that calculates the average sales for a week and answer the questions that follow:

```
1   #include <iostream>
2   using namespace std;
3   int main()
4   {
5          float sales[7];
6          float sum = 0, avg;
7          int index = 0;
8          while(     )
9          {
10              cout << "Enter sales ";
11              cin >> sales[index];
12              sum += sales[index];
13              index++;
14         }
15        // Calculate the average sales
16        cout << "Average sales is " << avg;
17        return 0;
18  }
```

9.1.1 Define the term *one-dimensional array.* (2)

9.1.2 Rewrite the code in line 5 to initialise all of the elements in the array to 0. (1)

9.1.3 How many elements can be stored in the array? (1)

9.1.4 What is the index position of the first element in the array? (1)

9.1.5 Complete the missing condition in line 8. (1)

9.1.6 Write the code statements to be included after line 15 to calculate the average sales. (1)

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9.2 Object-oriented programming (OOP) is a programming methodology that uses the concept of classes and objects (which have both attributes and methods).

Study the following simple definition of a class in C++ to represent a cylinder object.

```
#ifndef CYLINDER_H
#define CYLINDER_H

class Cylinder {
private:
    double radius;
    double height;
public:
    Cylinder();
    Cylinder(double r, double h);
    void setRadius(double r);
    void setHeight(double h);
    double calculateVolume() const;
    void display();
};

#endif // CYLINDER_H
```

9.2.1 Define the term *class.* (2)

9.2.2 How many methods are contained in the class? (1)

9.2.3 State the name of the constructor. (1)

9.2.4 Write the C++ code statement to instantiate an object called myShape that is of the type Cylinder. (1)

9.2.5 Considering QUESTION 9.2.4, how can the data for the Cylinder object be displayed? (1)

9.3 Provide the output of the following snippet of code:

```
string s1 = "November_", s2 = "Examination_", s3 = "2024";
string s4 = s1 + s2 + s3;

int len = s4.length();
cout << s4 << endl;
cout << "Length of s4 is: " << len << endl;

cout << s2.substr(0,4);
```

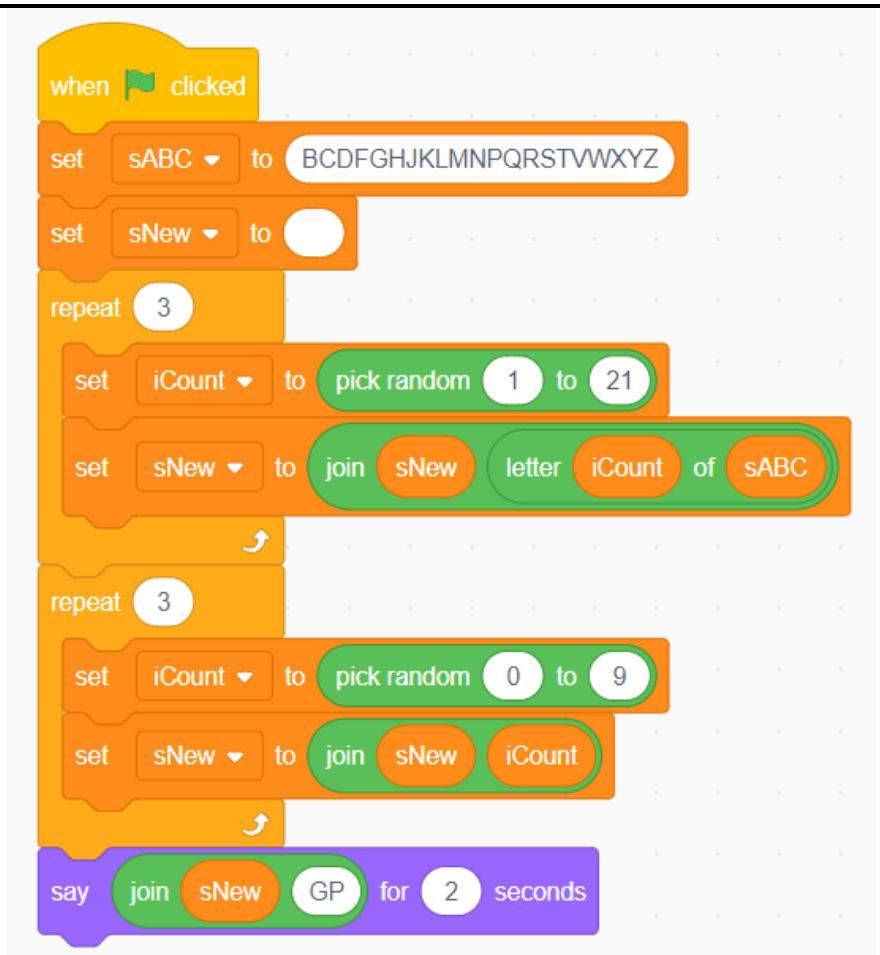
(4)

9.4 Study the following snippet of output:

```
He said, "Don't forget to use the '\t' for tabs!"
  This line starts with a tab.
```

Write a single cout statement to produce the output exactly as shown, including quotation marks and new lines. Use escape sequences where necessary. (4)

9.5 Study the following snippet of code made in a visual programming language.



Explain in your own words what the first repeat block of statements does. (2)

[23]

TOTAL SECTION B: 90
GRAND TOTAL: 120

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