CINEC CAMPUS
Beyond A Graduate

# Faculty of Engineering & Technology
# Department of Electronics & Telecommunication Engineering
# BSc Hons (Eng) Mechatronics Engineering
# Final Examination 2025

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| **Module Code** | : | **EE2328** |
| **Module Title** | : | **Virtual Instrumentation** |
| **Date/Time** | : | **18th June 2025** |
| **Examiner** | : | **Mr. Peshan Sampath** |
| **Time Allowed** | : | **3 Hours** |

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## INSTRUCTIONS TO CANDIDATES

- This is a **closed book** examination.
- This paper consists of twelve (12) pages.
- This paper consists of Section A and Section B.
- Section A consists of 15 MCQ type questions and Section B consists of 02 Structured essay type questions.
- You should attempt **ALL** questions.
- Use **Annex. II** (Page 12) to answer the Section A and securely attached to the answer booklet.
- Use only the CINEC Answering Booklet. Additional sheets may be requested from the invigilators.
- Read all the questions before attempting to answer.

## MATERIALS REQUIRED

- CINEC answering Booklet; Extra answering paper; **Annex. II** (Page 12).
- You may use a scientific calculator. This must not be programmable.

## Section A

### Instructions

- This section contains **15** Multiple Choice Questions (MCQ) type questions.
- Answer **all** questions.
- Each MCQ carries 02 marks.
- In each of the questions **1** to **15**, pick one of the alternatives from (A), (B), (C), (D) which is **correct** or **most appropriate** and **mark your response on the Annex. II (Page 12) with a cross (×).**
- Attach the **Annex. II** to your answer booklet.

01. What is **NOT** a difference between the *front panel* and the *block diagram* of a LabVIEW program?

A. The front panel is used for user interaction, while the block diagram is not.

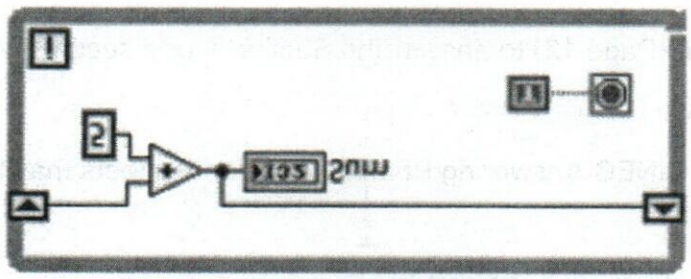
B. The front panel displays controls and indicators, whereas the block diagram is only for programming.

C. The front panel allows real-time data visualisation, while the block diagram does not provide such functionality.

D. The block diagram is used interchangeably with the front panel in LabVIEW documentation.

02. The following SubVI is loaded into memory and then run. At some later time it is still in memory and is run a second time.

What is the value displayed in the Sum indicator when the SubVI completes execution the second time it is run?



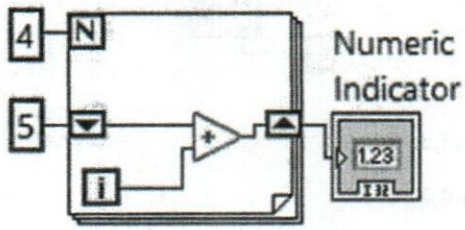
A. 5

B. 10

C. There's no way to find the exact value.

D. 0

03. What is the final value shown in the Numerical Indicator shown in the below graphical code, after running the following graphical code in LabVIEW once?




A. 6 B. 10

C. 11 D. 15

04. Which of the following statements is **NOT** valid:

A. You can make a Cluster of Clusters.

B. You can make an Array of Arrays.

C. You can make a Cluster of Arrays.

D. You can make an Array of Clusters.

05. What happens if you try to index an array at a position that doesn't exist in LabVIEW?

A. The program crashes.

B. The array is resized.

C. It returns the default value for the array's data type.

D. It returns an error message.

06. Which combination of words correctly completes the following statement? The _____ indicates the total number of times the loop will execute and the _____ returns the number of times the loop has executed minus one.

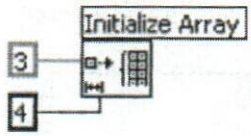
A. Conditional terminal,  ; Count terminal,  .

B. Count terminal,  ; Iteration terminal,  .

C. Conditional terminal,  ; Iteration terminal,  .

D. Count terminal,  ; Conditional terminal,  .

07. What is the output of the initialize array function after the following code has executed?



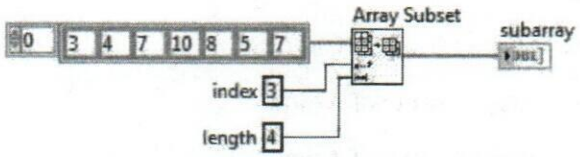

A. 1-D array of {3,3,3,3}

B. 1-D array of {4,4,4}

C. 1-D array of {3,4}

D. 1-D array of {4,3}

08. What is the result in **subarray** after the following code has executed?




A. 1-D Array of {8, 5, 7}

B. 1-D Array of {10, 8, 5}

C. 1-D Array of {10, 8, 5, 7}

D. 1-D Array of {7, 10, 8, 5}

09. The most efficient method for creating an array is:

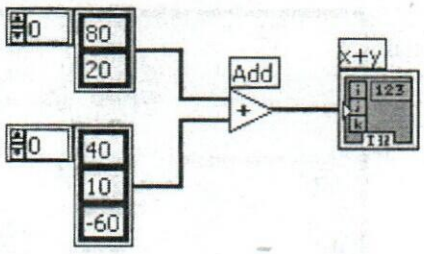
A. Initializing an array and then replacing elements in a While Loop

B. Placing a Build Array function in a While Loop

C. Using a For Loop with Auto-Indexing

D. Using a While Loop with Auto-Indexing

10. What is the result of the following array addition?




A. 1-D Array of {80, 20, 40, 10, -60}

B. 1-D Array of {120, 30, -60}

C. 1-D Array of {120, 30}

D. 2-D Array of {{120, 90, 20}, {60, 30, -40}}

11. You are inputting data that represents a circle. The circle data includes an x position, a y position, and a radius. All three pieces of data are double-precision. In the future, you might need to store the colour of the circle, represented as an integer. How should you represent the circle on your LabVIEW front panel window?

A. Three separate controls for the two positions and the radius.

B. A cluster containing all of the data.

C. A type definition containing a cluster.

D. An array with three elements.

12. Which of the following is the best method to update an indicator on the front panel?

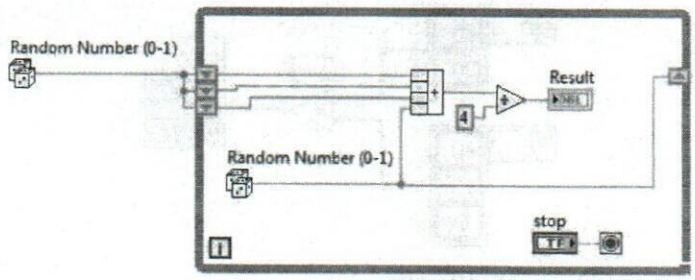
A. Use a Local Variable.

B. Use a Functional Global Variable.

C. Wire directly to the indicator terminal.

D. Use a Value Property Node.

13. Which of the following accurately describes the output that results from execution of the following loop?




A. The last three values from the Random Number function will be displayed.

B. A running average of all measurements will be displayed.

C. An average of the last four measurements will be displayed.

D. None of the above

14. Which of the following statement is **TRUE** about the iteration terminal [i] ?

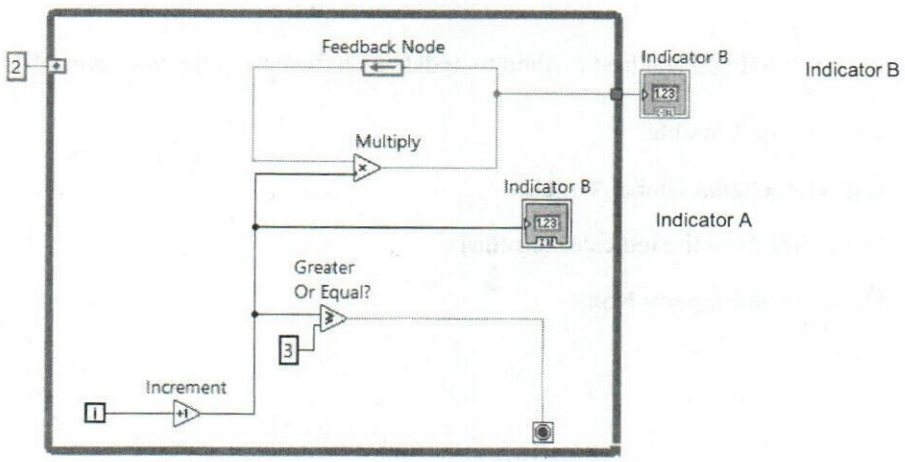
A. It returns the number of times the loop has executed.

B. It returns the number of times the loop has executed, plus one.

C. It returns the number of times the loop has executed, minus one.

D. It returns a constant number.

15. What would be the final values indicated in the *Indicator A* and *Indicator B* respectively, after running the following graphical code in LabVIEW **once**?




A. 3 and 12

B. 3 and 6

C. 4 and 12

D. 4 and 6

**[Total 30 Marks for Part A]**

## Section B

(Answer all questions)

**Question 1**

i. What do you mean by the term **virtual instrumentation**? (3 marks)

ii. Differentiate traditional instruments and virtual instruments by considering at least three (3) features of them. (6 marks)

iii. Compare text-based programming and graphical programming by discussing at least three key differences between them. (3 marks)

iv. LabVIEW is a graphical programming environment widely used by engineers and scientists. Identify three (03) application areas where LabVIEW is commonly used. (3 marks)

v. List three (03) data types available in LabVIEW and provide an example for each type. (3 marks)

vi. In LabVIEW, differentiate between the While Loop and the For Loop using a suitable sketch of their structures. Explain how each loop executes, especially in terms of iteration control and termination conditions. (3 marks)

vii. Briefly explain the behaviour of the LED on the front panel corresponding to the execution of the graphical code in Figure Q1? (3 marks)

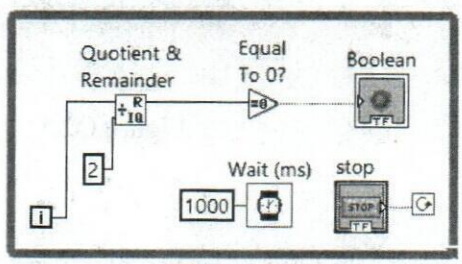



Figure Q1

viii. How can you use a **Flat Sequence Structure** with two frames and a **While Loop Structure** to obtain the similar behavior of the LED in the above question? Illustrate your solution by drawing the suitable graphical code. (6 marks)

**[Total 30 Marks for Question 1]**

**Question 2**

i. Briefly explain the use of the Front panel and the Block diagram of a LabVIEW Virtual Instrument. (3 marks)

ii. In LabVIEW block diagrams, wires are displayed in various styles and colours. Explain the importance of these differences in wire appearance by using appropriate example(s) to support your answer. (4 marks)

iii. Refer the Labview Front panel shown in Figure Q2.1 and design a temperature indicator where the input is provided by a slider in °C. Display the temperature on a waveform chart, showing the values in both Celsius and Fahrenheit. Additionally, incorporate two LEDs: the RED LED should light up when the temperature exceeds 100°F, and the GREEN LED should light up when the temperature falls below 32°F. (6 marks)

*(You do not need to draw the exact blocks or icons. A basic shape with the correct labelling will suffice.)*

*Hint:* $^{o}F = {}^{o}C \times \frac{9}{5} + 32$

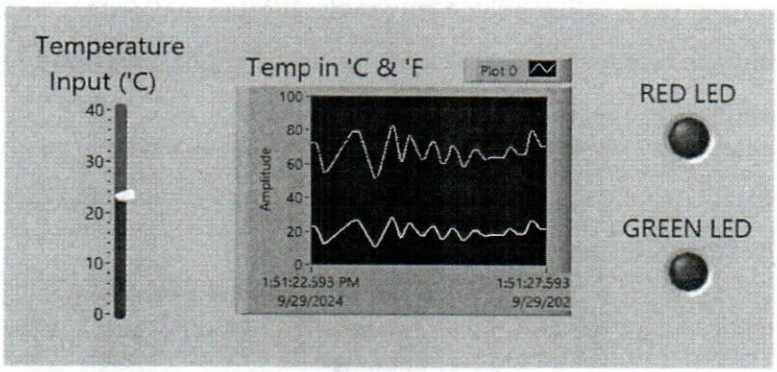



Figure Q2.1

iv. Refer to the block diagram and front panel in Figure Q2.2, and identify and state the following values. (5 marks)

a. max value :
b. max index(es) :
c. min index(es) :
d. size :
e. What is visible in the subarray?

Hint: *The figures show the state of the code before execution. Submit your responses based on the results obtained after running the program once.*

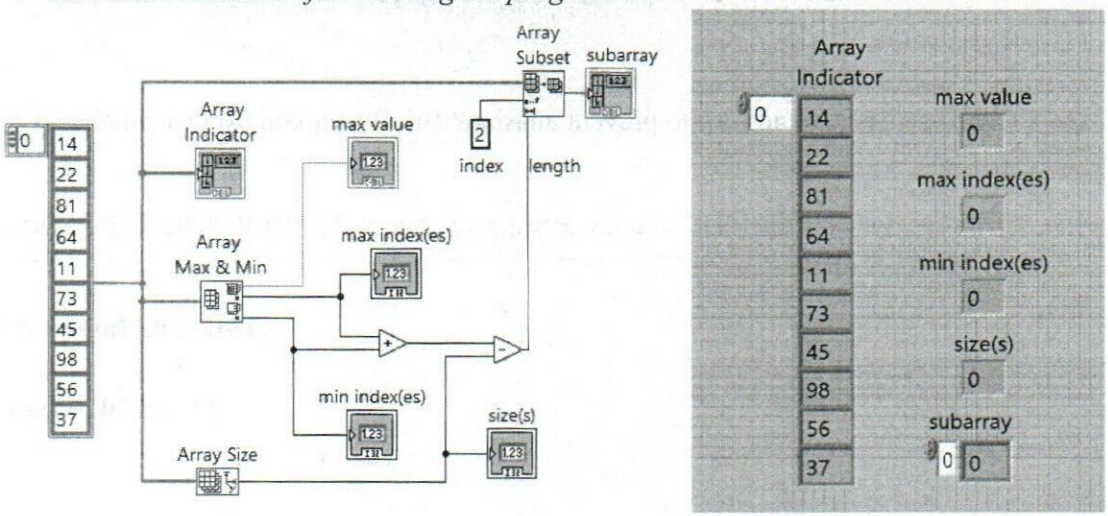



Figure Q2.2

v. What is the role of a shift register in the while loop? (2 marks)

vi. Based on the given front panel in Figure Q2.3, design and draw the LabVIEW block diagram to compute the factorial of a given number N. Use appropriate loop structures and explain the data flow used in your solution.

The Front panel of your VI should be the same as **Figure Q2.3**. (10 marks)

Hint: $n! = n \times (n-1) \times (n-2) \times \ldots\ldots\ldots\ldots \times 2 \times 1$

$5! = 5 \times 4 \times 3 \times 2 \times 1 = 120$

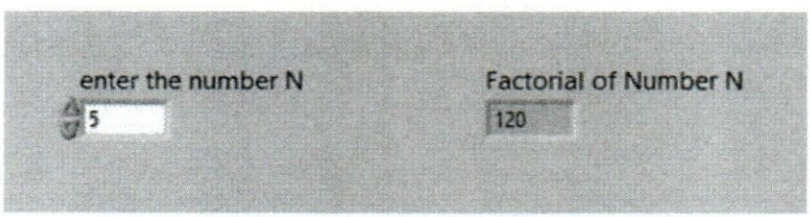



Figure Q2.3

vii. Briefly explain the requirement of signal conditioning. (2 marks)

viii. What is Analogue to Digital conversion? Briefly explain the importance of Analogue to Digital conversion. (2 marks)

ix. What is aliasing, and how to prevent aliasing? Briefly explain using a suitable example. (3 marks)

x. You are given a 3-bit ADC to convert values between 0 to 10 V. What will be the digital output if the input is 6.8 V? (3 marks)

**[Total 40 Marks for Question 2]**

**[Total 70 Marks for Part B]**

**END OF THE PAPER**