Certified LabVIEW Developer Examination

Examinee _____ Date: _____

Administrator _____ Date: _____

Instructions:
If you did not receive this exam in a sealed envelope stamped "NI Certification," **DO NOT ACCEPT** this exam. Return it to the proctor immediately. You will be provided with a replacement exam.

Please do not detach the binding staple of any section. If any part of the exam paper is missing or detached when returned to National Instruments, you will be deemed to have failed the exam.
This examination may not be taken from the examination area or reproduced in any way.
You may not keep any portion of this exam after you have completed it.
Please do not ask the proctor for help. If you believe the intent of any part of the exam is not clear, you may make appropriate assumptions. Please document your assumptions either on the question paper or on the LabVIEW block diagram.
The exam requires you to develop a LabVIEW application based on a set of specifications.
A computer with a standard installation of LabVIEW is the only reference allowed for the examination. Externally developed code and third party tools are not allowed in the exam.
You may use LabVIEW design patterns, templates, and examples available in the development environment as a guide/resource for the application development.
The application must be specifically developed for the exam submission.
Submit your finished application on the disk provided.
Total time allocated for the exam: 4 hours
Exam passing grade: 75%

Grading:
The application development exam consists of a total of 40 points which are allocated as follows:

Programming style **(15 points)**
Functionality **(15 points)**
Documentation **(10 points)**

IMPORTANT:

When you have completed the exam, place the exam document, the disk with the saved application, and any deliverables in the envelope provided.
Please SEAL the envelope.
Give the sealed envelope to your proctor.

Application Development
Section I: General Requirements

The Certified LabVIEW Developer exam tests your ability to develop a LabVIEW application.

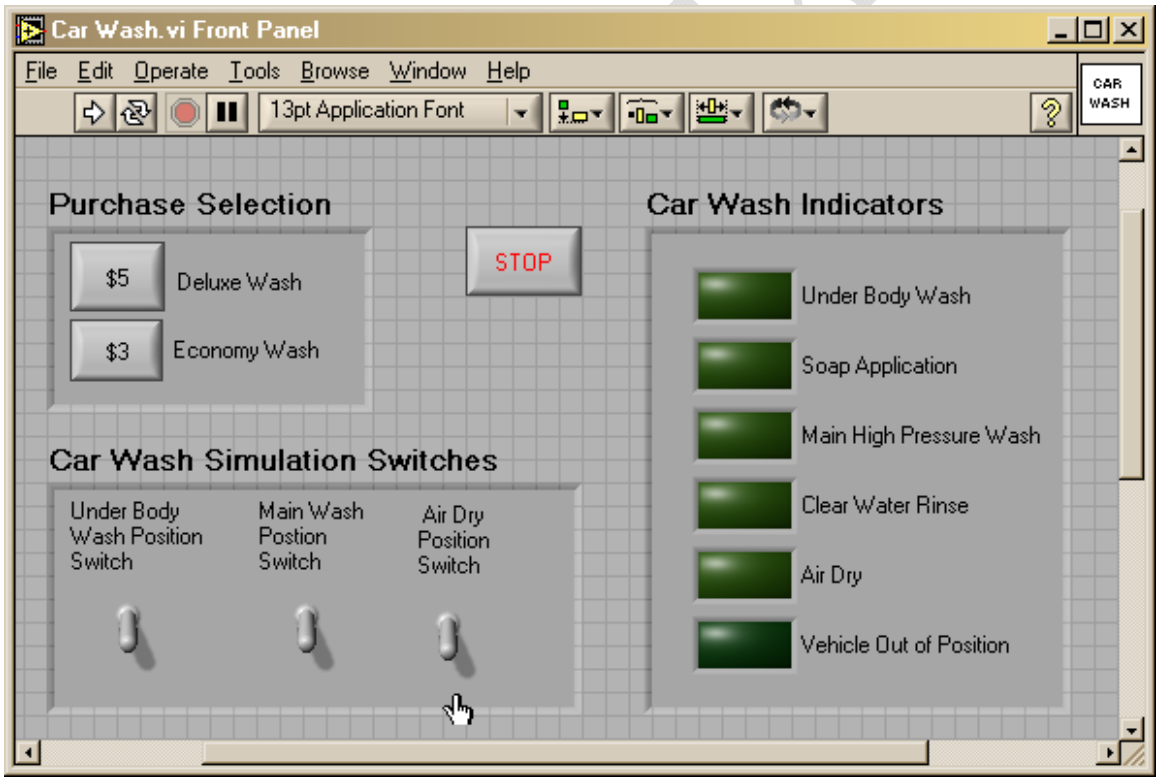
The application should:

- Function as specified in Section II of this document.
- Conform to LabVIEW coding style and documentation standards (found in LabVIEW documentation – LabVIEW Development Guidelines).
- Be created expressly for this exam using VIs and functions available in LabVIEW. Templates, examples, or code developed outside the bounds of this exam are not acceptable for use in the application.
- Be hierarchical in nature. All major functions should be performed in subVIs.
- Use a state machine that either uses a type defined enumerated control, queue, or Event structure for state management.
- Be easily scalable to add more states / features without having to manually update the hierarchy.
- Minimize the use of excessive structures, variables (locals / globals) and Property Nodes.
- Respond to front panel controls (within 100 ms) and not utilize 100% of CPU time.
- Close all opened references and handles where used.
- Be well documented and include the following:
  - Labels on appropriate wires within the main VI and subVIs.
  - Descriptions for each algorithm.
  - Documentation in VI Properties » Documentation for both main VI and subVIs.
  - Tip strip and Description for front panel controls and indicators.
  - Labels for constants

Application Development
Section II: Application Requirements
Car Wash Controller

Task:
Your company has received a contract to design a controller for a touch-less car wash. A touch-less car wash is one that relies on water spray only, there are no brushes. The specifications and rules are listed below. Your job is to design a controller using LabVIEW that satisfies all specifications.

Instructions:
Using a front panel similar to the graphic provided, create a LabVIEW application that implements the actions of the procedure. For this application, the car wash switches are simulated by switches on the Front Panel. The car wash starts when a purchase switch has been selected. The execution of a cycle is denoted by illuminating the appropriate LED. For this application, each cycle's duration should be set to 5 seconds unless otherwise stated in the Operating Rules below.



Car Wash Specifications

Purchase Options

$5 Deluxe Wash
$3 Economy Wash

Cycles and associated timing:

1. Underbody Wash – 10 seconds
2. Soap Application – 5 seconds
3. Main High-Pressure Wash – 5 seconds
4. Clear Water rinse – 5 seconds
5. Air Dry Cycle – 10 seconds

Car Wash Operating Rules

1. Only one purchase selection can be made at a time. The car wash should not accept a second purchase selection while the car wash is in operation.

2. Not all cycles are performed for each wash. The more expensive wash performs more cycles. The list of cycles performed are:
   Cycles performed for the Deluxe Wash: 1 – 2 – 3 – 4 – 5
   Cycles performed for the Economy Wash: 2 – 3 – 4

3. Each cycle is initiated by a switch. If the vehicle rolls off of the switch, the wash immediately pauses and illuminates an indication to the driver to re-position the vehicle. The amount of time that expires while the car is out of position should not count against the wash time.

4. Underbody Wash Cycle: The spray heads for this wash are located near the entrance of the car wash. The underbody spray heads are fixed in position, and require the vehicle to slowly drive over them to wash the underbody of the vehicle. The Underbody Wash is activated under the following conditions:
   a. The Deluxe Wash has been purchased.
   b. The car wash is in the Underbody Wash cycle.
   c. Under Body Wash Position Switch is closed (proximity switch).

   This cycle of the wash should last for 10 seconds. Upon completion of this cycle the controller should signal moving to the next cycle by activating the Vehicle Out of Position LED.

5. Main Wash Cycle: Main Wash Position Switch verifies the vehicle is in the correct location for the wash cycles (cycles 2, 3 and 4) to operate. Each cycle should last for 5 seconds. If the vehicle rolls off of the Main Wash Position Switch, the wash immediately pauses and illuminates an indication to the driver to re-position the vehicle. The amount of time that expires while the car is out of position should not count against the wash time. The wash resumes after the vehicle is properly positioned. Upon completion of this cycle the controller should signal moving to the next cycle by activating the Vehicle Out of Position LED.

6. Air Dry Cycle: The air drier is a set of fixed position blowers located near the exit of the car wash. They require the vehicle to drive slowly out of the car wash through the air stream to dry the vehicle. The Air Dry Cycle activates on the following conditions:
    a. The deluxe wash has been purchased
    b. The car wash has reached the Air Dry cycle
    c. Air Dry Position Switch is closed (proximity switch)

   If the vehicle rolls off of the Air Dry Position Switch, the wash immediately pauses and illuminates an indication to the driver to re-position the vehicle. The amount of time that expires while the car is out of position should not count against the Air Dry time. The wash resumes after the vehicle is properly positioned. This cycle of the wash should last for 10 seconds. Upon completion of this cycle the controller should allow the next vehicle in line to select another wash.

7. The Car Wash must respond to the STOP Boolean and Vehicle Position Switches within 100mS. The STOP Boolean aborts the operation of the VI.