Certified LabVIEW Architect Recertification
(CLA-R) Exam
Preparation Guide

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LabVIEW Certification Overview

The National Instruments LabVIEW Certification Program consists of three certification levels:

- Certified LabVIEW Associate Developer (CLAD)
- Certified LabVIEW Developer (CLD)
- Certified LabVIEW Architect (CLA)

The CLD certification is a prerequisite to taking the CLA exam. There are no exceptions to this requirement for any exam.

Each certification level requires recertification to maintain a valid certification status. Please see the Recertification Policy and Process for more information.

Exam Overview

CLA-R exam details:

- Product version: LabVIEW 2021
- Format: Multiple choice, 28 questions
- Duration: 1 hour
- Total points: 28
- Passing grade: 70%

The exam validates problem-solving skills, knowledge and experience in the architecting of measurement and automation applications using LabVIEW. The exam does not involve any software development or any hardware-related questions.

The use of resources available in LabVIEW, such as the *LabVIEW Help* and examples are not allowed during the exam.

For general questions or comments, please fill out this form or email us at services@ni.com.

Exam Topics

Since a CLA has proven a mastery of LabVIEW, the CLA-R exam encompasses all the topics listed in the preparation guides for all certification levels.

Specifically, the CLA-R is closely aligned with the topics covered in the following two advanced-level LabVIEW training courses:

• Managing Software Engineering in LabVIEW
• Advanced Architectures for LabVIEW

Because of the nature of the CLA exam, some important CLA topics are not thoroughly tested in the CLA exam. CLA-R exam tends to emphasize those topics and also tests on some of the advanced and newer features from the last two releases of LabVIEW.

The CLA-R exam tests your experience as a CLA and your ability to evaluate short application scenarios and select the most appropriate solution or answer.

CLA-R exams are grouped under two topic groups as follows:

Topic Group	Number of Questions	Points per Question	Total Points
Software Engineering for Test Applications	14	1	14
Advanced Architectures in LabVIEW	14	1	14

Total	28		28

For each of the topic groups, the following tables list the CLA-R topics and the approximate number of questions for each of the topics on the exam:

#	Software Engineering for Test Applications	Number of Questions
1.	Software development methodology	2
2.	Configuration management tools	2
3.	Requirements management	3
4.	Estimation techniques	1
5.	LabVIEW project organization	2
6.	Code review	2
7.	Verification and validation	1
8.	Functional testing	1
9.	Deployment	1

#	Advanced Architectures in LabVIEW Exam Topic	Number of Questions
1.	API design	3
2.	Data passing and data communications	2
3.	Design patterns	1
4.	Parallel processes and daemons	1
5.	Subpanels	1
6.	XControls	2
7.	Plug in architectures	1
8.	Reference management	2
9.	LabVIEW Object Oriented Programming	1
10.	Error handling	1

Software Engineering for Test Applications

Exam Topics (Overview)

Topic	Detail
1. Software development methodology	a. Software lifecycle models – terminology and uses cases b. Project manager and Software architect roles c. Project management methodology, tools and techniques d. Software engineering process methodology, tools and techniques
2. Configuration management tools	a. Configuration management methodology b. Configuration management tools - uses cases, compare and contrast tool, team policies for tool use c. LabVIEW tools for configuration management
3. Requirements Management	a. Requirements management and its emphasis in project management and software engineering process b. Assumption, constraints and requirements definition c. Requirements management tools and techniques d. LabVIEW tools for requirements management
4. Estimation techniques	a. Software size and effort estimation methods, tools and techniques b. LabVIEW tools for estimating software development
5. LabVIEW project organization	a. Developing team standards and guidelines for project hierarchy and file organization b. LabVIEW project API to automate development tasks
6. Code Review	a. Emphasis and importance of code review b. Code review process and activities c. LabVIEW tools and techniques for performing code review
7. Verification and Validation	a. Use of requirements in project code verification b. Validation of software for failure and performance

	c. Knowledge of LabVIEW Professional tools and techniques
8. Functional testing	a. White and black box testing b. Types of functional validation and code coverage c. LabVIEW tools and techniques for functional testing
9. Deployment	a. Project and software deployment processes b. Project organization and build specifications c. Issues and caveats in deploying applications to multiple operating systems, languages and targets

Advanced Architectures in LabVIEW

Exam Topics (Overview)

Topic	Subtopic
1. API Design	a. Design consideration and best practices for API VIs b. Polymorphic VIs c. Project libraries
2. Data communications	a. Data passing methods for different application requirements b. By value or by reference c. Dynamic and user defined events d. Queues, Single element queues, Notifiers, Data value references
3. Design patterns	a. Selection of scalable design pattern most appropriate for application requirements b. Design consideration for customization of standard design patterns c. Reentrancy and recursion
4. Parallel processes and daemons	a. Asynchronous VIs – daemons , spawned VIs, launchers b. VI server c. VI templates d. Reentrancy and recursion e. Iteration parallelism

5. Subpanels	a. Design considerations for implementing in user interfaces b. VI server
6. XControls	a. Use cases for XControls b. Abilities, properties and methods and supporting VIs c. Design decisions and considerations for XControl development d. Error handling e. Programming caveats and techniques
7. Plug in architectures	a. VI server b. Recursion c. Dynamic and scalable architectures using LabVIEW classes
8. Reference management	a. Functional global variables b. Single element queues c. Data value references
9. LabVIEW Object Oriented Programming (LVOOP)	a. Encapsulation b. Class hierarchy c. Dynamic dispatch d. Application design considerations using LVOOP
10. Error handling	a. Design error handling, logging, display for scalable architectures b. Design appropriate and safe shutdown

CLA-R Exam Preparation Resources

Use the following resources for additional exam preparation:

- LabVIEW Documentation
- LabVIEW Core 1, 2 and 3
- Software Engineering for Test Applications
- Advanced Architectures in LabVIEW

These courses are available on-demand, as video recordings online that can be reviewed at your own pace. Some courses may be available in live instructor-led formats, like Classroom or Virtual. Learn more about these courses.

Certified LabVIEW Architect Recertification Exam

Test Booklet

Certified LabVIEW Architect Recertification Exam Test Booklet

Note: The use of the computer or any reference materials is NOT allowed during the exam. 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 ask the proctor for help. If you believe the intent of a question is not clear, you may note that question, and your reasons for choosing the answer you believe best fits the question.
- 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.

Exam Details:

- Time allocated: 1 hour
- Type of exam items: Multiple choice
- Number of exam items: 28 questions
- Possible points: 28 points
- Passing Grade: 70%

IMPORTANT: When you have completed this exam, place it in the provided envelope with you answer sheet and SEAL the envelope. Give the sealed envelope to your proctor.

Sample Exam Notes:

- Questions in this sample exam are grouped together (see topic grouping in CLA-R Preparation Guide) to aid in exam preparation. In the actual exam, questions will be randomly distributed.
- Question 1 (matching question) is only in this sample exam. Questions of this type will not be on the actual exam.

Answer Sheet:

To quickly check your answers against the solutions on the Solutions Page, record your answers on this Answers Sheet. Detach this page and record your answers as you go along. This page is not included in the actual CLA-R exam; it is included here for practice purposes only. The Solutions Page is at the end of the Sample Exam.

Answer	Topic
1. _____	Software development methodology
2. _____	Software development methodology
3. _____	Configuration management tools
4. _____	Configuration management tools
5. _____	Requirements Management
6. _____	Requirements Management
7. _____	Requirements Management
8. _____	Estimation techniques
9. _____	LabVIEW project organization
10. _____	LabVIEW project organization
11. _____	Code Review
12. _____	Code Review
13. _____	Verification and Validation
14. _____	Functional testing
15. _____	Deployment
16. _____	API Design
17. _____	API Design
18. _____	API Design
19. _____	Data Passing
20. _____	Data Passing

21. _____ Design patterns
22. _____ Parallel processes and daemons
23. _____ Subpanels
24. _____ XControls
25. _____ XControls
26. _____ Plug in architecture
27. _____ Reference management
28. _____ Reference management
29. _____ LabVIEW Object Oriented Programming
30. _____ Error Handling

1. The king hires your team to produce software for his new astronomy observatory. When the software was eight months late, he commissioned an external audit to find out why the software was late so he could determine who to send to the Executioner's Block. The software audit revealed four issues that contributed to the lateness of the project. Match the failure with the person who should have handled the issues better.

1. The king added new requirements late in the process and was not told to expect a later release date. 2. Bugs found early in design kept recurring because no new tests were added to test suite when bugs were first fixed. 3. Test suite was only executable on central build machine, not on each developer's machine, so changes could not be checked before being submitted. 4. Control refnums were passed into the main DAQ analysis subroutine, so when UI was adjusted, the DAQ module also needed rewriting.	a) Project Manager b) System Architect c) Developer d) Test Engineer

2. Using LabVIEW, you design a software application with a very interactive and end-user driven user interface. The customer gave you a high-level definition of the user interface and he needs your assistance in designing and testing this as the software evolves. What

software development life cycle methodology is this development cycle closely related to? a. Waterfall b. V - model

c. Spiral model

d. Agile model

3. Which of the following is an advantage of source code control over VI Revision?

a. Facilitates creation of comments to describe code changes

b. All source code control providers can be integrated into LabVIEW

c. Creates a revision number that is saved as part of the VI

d. Facilitates file checkout and locking to prevent simultaneous editing of code

4. Which of the following configuration management tools is NOT provided as part of the LabVIEW Professional Development System?

a. Revision History

b. VI Compare

c. LabVIEW Source Code Control

d. VI Merge

5. You are put in charge of a project that is currently under execution in the development phase. In the first week as a project manager, you receive emails requesting changes. What is one of the first things you should do?

a. Consult the project scope document

b. Meet with the customer to discuss the changes

c. Refuse the changes as they affect either scope, budget, or schedule constraints

d. Call a team meeting to incorporate the changes and then bill the customer

6. You are brought on to lead a LabVIEW project that is currently in the development phase. While reviewing the project document, you realize that several key features currently under development are based on a set of assumptions that were documented at the beginning of the project. How will you handle these assumptions?

a. Stop all the development activity and clear the assumptions with the stakeholders
b. Evaluate the risk associated with each assumption and develop a contingency plan in case the assumptions prove to be false
c. Rely on the expertise of the project team and allow development to continue
d. Stop the development activity on the modules with assumptions are deemed incorrect but allow other development to continue

7. Which of the following statements is an example of a constraint that should be identified in the project requirements document?

a. Develop the application for execution on a Windows 95 computer
b. The user interface must include the corporate logo of the company that hired you to develop the application
c. The application must acquire data at a rate of 1000 samples per second
d. The development cost of the application must be less than $10,000

8 Which of the following is an estimating technique can directly be used with the tools available in LabVIEW?

a. Source lines of code (SLOC) estimation
b. Function point estimation
c. COCOMO II estimation
d. PERT estimation

9. You have numerous VIs that use a typedef of a cluster containing several elements, some instances of which use different default values for elements of the cluster in a control or constant. Which of

the following edits can be made without resetting the default value of these elements?

a. You can add new elements at any location within the cluster as long as no previously existing element names are changed.
b. You can add new elements to the end of the cluster and you can change the names of previously existing elements.
c. You can modify both the order of elements in the cluster and the names of elements as long as all callers are in memory when the edit is made.
d. You can modify both the order of elements in the cluster and the names of elements in a single edit as long as all callers are not in memory when the edit is made.

10. Which of the following is not a type of a project library?

e. Shared Variable
f. XControl
g. LabVIEW Class
h. StateChart

11. Which of the following is a risk associated with **NOT** conducting module code reviews?

a. The code may not satisfy all functional requirements
b. The code may not perform as expected when it is deployed
c. The code may be more difficult to maintain due to improper programming style
d. The code may not behave as expected if run continuously for 24 hours

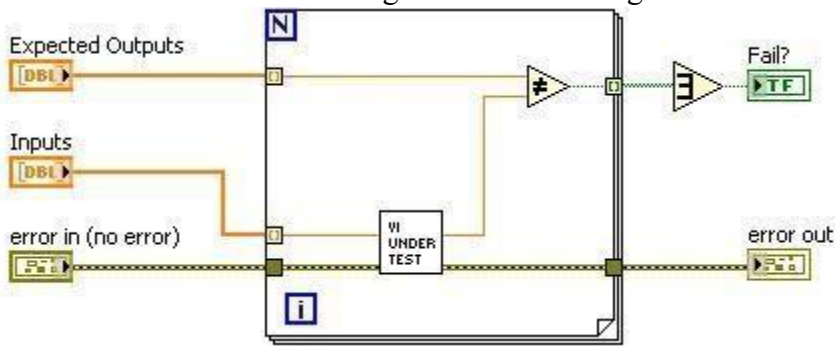
12. Which of the following individuals should **NOT** be involved in a code module review?

a. LabVIEW developer who implemented the module
b. End user of the application
c. LabVIEW architect for the project

d. LabVIEW developer who is working on a different section of code for the project

13. You complete development of your application and begin testing its performance. You use the Windows Task Manager to determine that your application uses far more memory than expected. You suspect that a memory leak may be occurring. Which tool can you use to identify specific LabVIEW memory allocations and deallocations and locate reference leaks that occur while the VI is running? a. Profile Performance and Memory Window
    b. Desktop Execution Trace Toolkit
    c. VI Analyzer Toolkit
    d. Unit Test Framework

14. What method of testing is shown in the figure below?



    a. Functional testing
    b. Reliability testing
    c. Configuration testing
    d. Performance testing

15. Which of the following coding practices is most likely to cause problems for localization of a VI?
    a. User-visible panels with enum controls
    b. User-visible panels with string controls whose default value is anything other than an empty string
    c. User-visible panels using non-system fonts

d. User-visible panels using non-system controls

16. You must develop an easy-to-use API for LabVIEW programmers to interface with a certain kind of data file. The API calls algorithms (that reside in subVIs) that you do not want users to call outside of your API. Which one of following API designs ensures that these requirements are met?
    a. Name-prefixed VIs within an LLB
    b. A DLL that users can access with the Call Library Node
    c. VIs within a LabVIEW Project Library
    d. VIs within a LabVIEW Project

17. Which of the following property settings is **NOT** appropriate for API VIs?
    a. Window Appearance: Default window appearance
    b. Execution: Enable automatic error handling
    c. Execution: Disable run when opened
    d. Window Size: Disable scale all objects on front panel as the window resizes

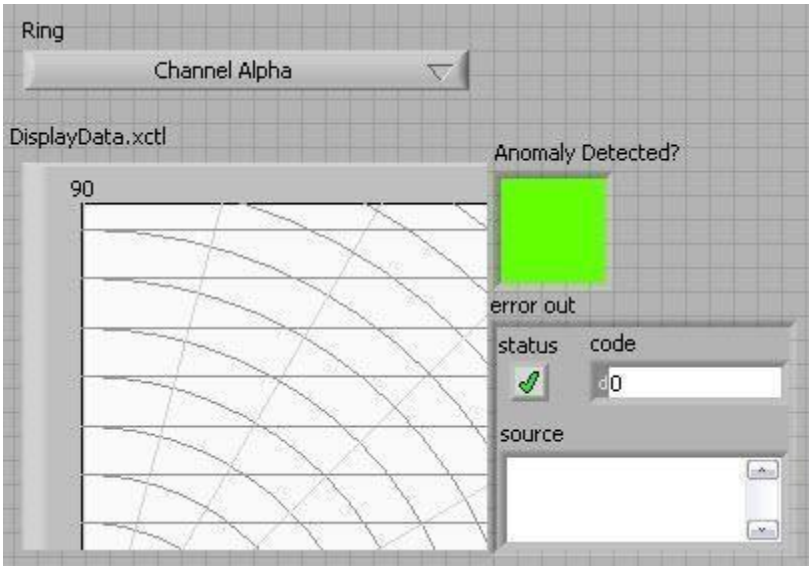
18. Which of the following statements about Polymorphic VIs is false?
    a. Each input terminal on one instance VI must be an input terminal or an empty terminal on every other instance VI.
    b. In order to select the **Allow Polymorpic VI to Adapt to Data Type** option, all of the instance VIs must have at least one input terminal in common.
    c. Selecting the **Draw Instance VI Icon** option of a Polymorpic VI causes the LabVIEW to use the documentation properties of the Instance VI, rather than the Polymorphic VI, to display context help.
    d. All of the instance VIs in a Polymorphic VI must use the same connector pane pattern.

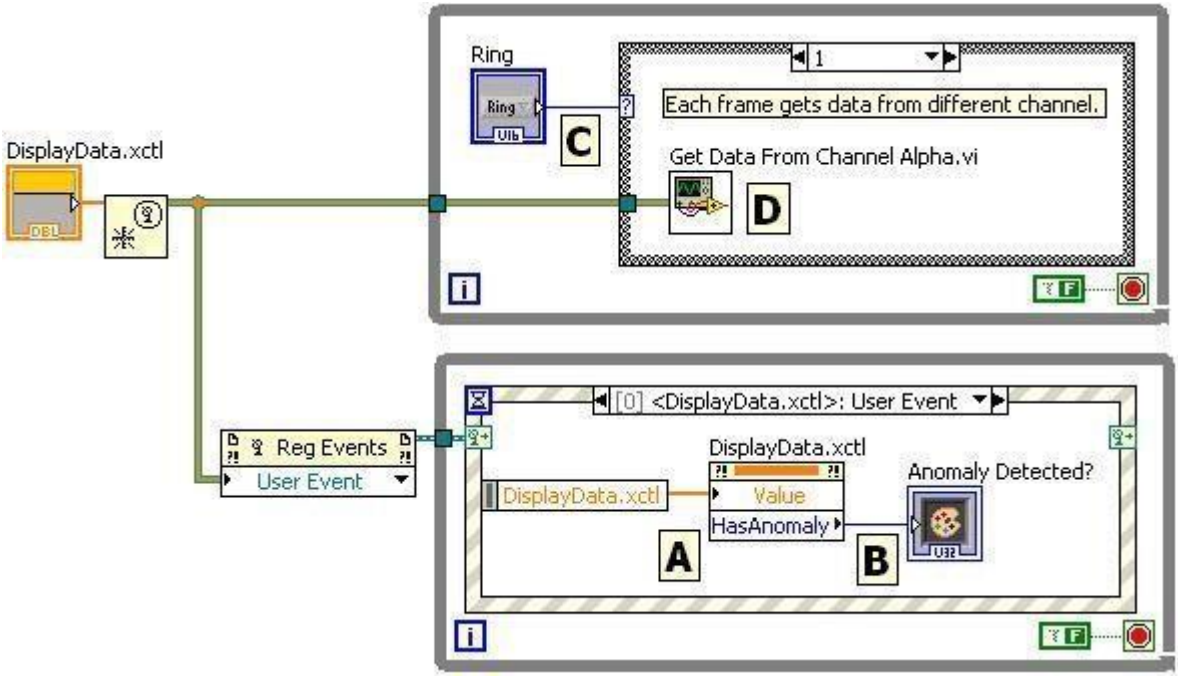
19. Choose the data type that is contrary to dataflow:
    a. String
    b. LabVIEW Object
    c. Variant
    d. Data Value Reference

20. You use a single element Queue to pass data between VIs in an API. Assume that an initialization VI creates the queue, a cleanup VI destroys it, and each other VI in the API dequeues an element, performs its operations, and then re-enqueues the element. The queue reference is passed between the VIs in the API using terminal connections. Assume that the API is used on Microsoft Windows targets. Which of the following statements is true?

    a. A single element queue allocates memory when created and does not need to allocate memory afterwards
    b. Two VIs in the API cannot perform their operations simultaneously
    c. While waiting for an element to become available, a VI uses processor resources to poll the queue
    d. The caller of the API can safely branch the queue reference wire without creating copies of the enqueued data

21. Which part of this diagram is **NOT** a failure to separate interface from implementation?



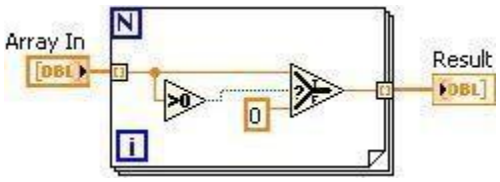


a. The evaluation of whether an anomaly exists is done by calling a property on DisplayData.xctl
b. The HasAnomaly property returns a int32 with a value of 0xFF0000FF (green) for “no anomaly” and 0xFFFF0000 (red) for “anomaly”
c. Ring control’s terminal is wired directly to the ? terminal of the case structure

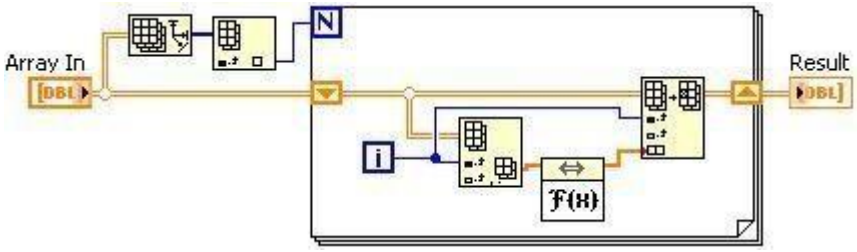
d. Top-level VI passes a user-defined event refnum into the data acquisition subroutines and the UI loop listens for that event

22. Which of the following loops is the best candidate for loop iteration parallelism?

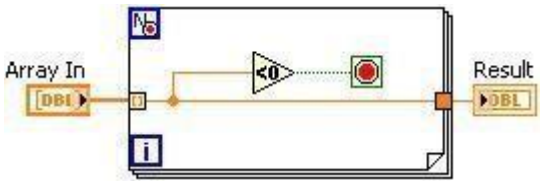
a.



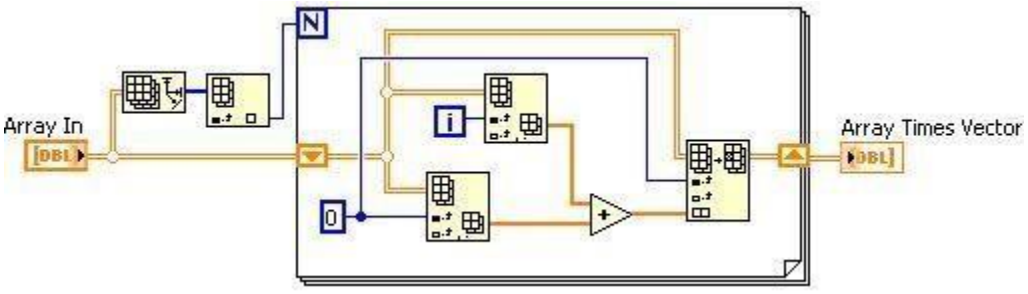
b.



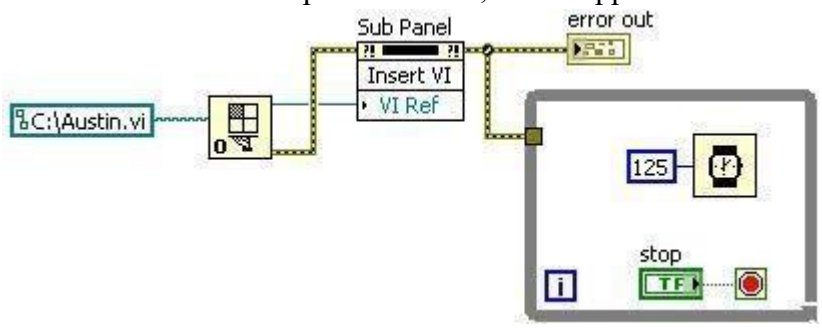
c.



d.



23. The front panel of *Austin.vi* is currently open. Assuming *C:\Austin.*vi is the correct path to the VI, what happens when this code runs?



a. The front panel of *Austin.vi* will close, and *Austin.vi* will appear in the subpanel

b. The front panel of *Austin.vi* will remain open, and *Austin.vi* will also appear in the subpanel c. An error will occur

d. None of the above

24. A user creates an XControl and defines a custom Boolean property. In response to a VI writing a value to this property, the XControl should turn an LED on or off in the Façade of the XControl. The correct way to do this is to:

a. Create a Boolean global variable. Update this variable in response to writing a value to the custom property. Monitor this global in a loop in the Façade and update the LED whenever the global changes value.

b. Store a reference to the LED as part of the XControl's state. Write to the Value property of the LED in response to writing a value to the custom property.

c. Define a Boolean field in the XControl's state. Update this field in the state in response to writing a value to the custom property. Handle the Display State Change event in the Façade and update the LED in response to the event.

d. Define a User event with Boolean data. Store the event as part of XControl's state. Fire this event in response to writing a value to the custom property. Handle the event in the Façade and update the LED in response to the event.

25. You are implementing a custom graph in an XControl. You must redraw the graph if the data changes, a property changes, a method is applied, the user resizes the graph, or if the user selects certain options from the shortcut (right-click) menu of the graph. Which of the following represents the best design for the redraw code?

a. Place the redraw code in the Display State Change event case of the Façade VI as all of the triggering conditions cause the Display State Change event to fire.
b. Place the redraw code in the Display State Change event case of the Façade VI and trigger a display state change from the other events by setting the State Changed? Element of the Action cluster to TRUE.
c. Place the redraw code in a case structure outside of the event structure and allow each event to control the case structure by writing TRUE or FALSE to the case selector.
d. Place the redraw code in a method VI and call the method from each of the triggering events.

26. You must architect a flexible UI that should only display relevant controls based upon a run time user selection of an item within a tree control. What situation makes the usage of sub-panels ideal and what would the tradeoff be when compared to utilizing a tab-control?

a. The list of items in the tree is dynamic. The tradeoff would require the use of the ‘Control Value.Get’ and ‘Control Value.Set’ methods in order to interact with front panel controls and indicators.
b. Sub-panels should never be used in this situation. Using a tab control allows direct access to the control terminals and makes debugging easier.
c. The list of items in the tree is dynamic. The tradeoff requires a more robust architecture to ensure that each unique dynamic panel loaded, implemented all needed functionality of a subpanel VI

d. The list of items in the tree is static. The tradeoff requires subpanel VIs to be created.

27 Which of the following are reasons for using single-element queues?

e. Single-element queues are more scalable than functional globals
f. Single-element queues can be used to produce atomic operations on data
g. Single-element queues are available on all LabVIEW systems
h. All of the above

28. Which type of Variable should you use to transfer data between VIs on different targets? a. Network-Published b. Single Process
c. I/O Variable
d. I/O Alias

29. What is not a drawback of utilizing sibling LVOOP classes within polymorphic VIs?
a. Dynamic dispatch VIs cannot be members of polymorphic VIs
b. Unless all possible class invocations of the polymorphic VI are not broken, regardless of whether they are used or not, the polymorphic VI will be broken as well
c. Non-identical connector panes could be utilized for a single Sub-VI node
d. Each sibling class' called sub-VImust have their own unique VI name from all other sibling classes if it also exists within the parent

30. You decide to increase the efficiency of your error handling code by replacing code segment 'A', which merges 4 separate error clusters, with code segment 'B', shown below. Which loss of functionality do you experience with code segment 'B'?

a. The output error cluster now only contains information for a single error
b. Warning information in the top three error wires will always be discarded
c. Errors with higher ‘code’ values are no longer prioritized
d. Errors with empty ‘source’ strings are not returned

Solutions Page:

Below are the answers and links to additional resources for the CLA-R Sample Exam. To quickly check your answers, record them on the Answer Sheet, detach the Answer Sheet, and compare it, side-by side, with the Solutions Page. This answer page is not included in the actual CLA-R exam; it is included here for practice purposes only.

Question	Answer
1	1A, 2C, 3D, 4B
2	C
3	D
4	C
5	A
6	B
7	D
8	A
9	C
10	A
11	C
12	B
13	B
14	A
15	A
16	C
17	B
18	B
19	D
20	D
21	D
22	B
23	C

24	C
25	C
26	C
27	D
28	A
29	C
30	B