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Question 1:

Choose the most suitable and correct answer for each of the following questions :

1) An embedded system can be defined as a control system designed to perform a

- A) generic purpose
B) specific purpose
(C) customized purpose
(D) Both B and C
- (60 Marks)

2) Each of the following hardware components can be found in an embedded system except for:

- A) microcontroller
B) firmware
(C) sensors
(D) actuators

(3) The following is a system whose

correctness depends on the response time.

(A) Embedded System (B) Realtime System

(C) Batch Processing System Both A and B

represents the signal that is sent by a device to request an interrupt in an embedded system.

(4)

A) An Interrupt Service Request

(C) An Interrupt Service Routine (5)

Which of the following is correct

(B) An Interrupt Service Priority

(D) An Interrupt Service Response about a synchronous event in an embedded system?

Occurs regularly within a time window and within a predictable period (B) Occurs irregularly within a time window and within a predictable period

(C) Occurs **regularly** within a time window and within an unpredictable period

(D) Occurs irregularly within a time window and within an unpredictable period

(6) Which of the following are valid use cases of a design pattern for an embedded system?

(A) Pattern Mining and Pattern Matching
Pattern Hatching and Pattem Design

(B) Pattern Instantiation and Pattern Mining.

(D) Pattern Instantiation and Pattern Generation

(7) Which of the following represents a valid design u case that is used to apply an existing patt embedded system under development?

(A) Pattern Mining

(C) Pattern Instantiation

(B) Pattern Hatching

(B) Pattern Generation

(8) Another popular name for an Observer design pattern is

(A) Publish Observe

Publish Subscribe (C) Publish-Listen-In

pattern

(D) None of the mentioned

(9) All of the following statements are valid about a real time trigger except for

It must be related to a timer

(C) It must be implemented with an ISR

(B) It can be or cannot be related to an event

(D) Only A and B are correct

(10) An embedded system design involves a HW/SW co-design methodology

which means that (A) HW design, SW design and interface design are all performed in parallel with no interaction between the the HW/SW system integration phase.

(B) HW design and SW design are performed in parallel with **continuous** interaction between them starting fr in the design process.

HW design, SW design and interface design are performed in parallel with **continuous** interaction starting from day one in the design process

(D) SW design and interface design are performed in parallel with continuous interaction between one in the design process. A

them starti

(11) A design trade-off spreadsheet compares between different design alternatives in terms of different

(C) design trade-offs (D)

design weights CA design optimization criteria

(B) design patterns

(12) A design trade-off spreadsheet compares between different design alternatives with different design

(A) weights

(B) scores

weighted scores (D) metrics

(13) The following represents a valid non-functional design optimization criterion except for

(A) performance

(B) reliability

Correct

functionality

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complexity

(14) Consider an embedded system that is responsible for sending emergency messages to save lives of workers at construction location. This system is considered as a

System.

Critical hard-realtime non-critical hard-realtime) (C) critical-soft-realtime (D) non-critical soft-realtime (15) Consider an embedded system that is responsible for controlling stream of videos over the Internet.

system is considered as a

system.

Critical hard-realtime (B) non-critical hard-realtime (C) critical-soft-realtime (D) non-critical soft-realtime (16) When designing an embedded system, system

synthesis is the stage where the system is

(A) specified using behavioural specifications

(B) specified using architectural specifications

verified using a high-level performance simulation

tool

(D) verified using a low-level C/HDL simulation

tool

(17) The HW/SW Co-design methodology

resembles (a) the waterfall software design methodology

(B) resembles the agile software design methodology

(C) resembles the agile and the waterfall software design methodologies

(D) None of the above

(18) The following is considered a characteristic of both a realtime **and** a non-realtime operating system.

Determinism

(B) Failure handling

(19) Earliest deadline first is considered a

er Fail-soft operation realtime scheduling algorithm

(D) User Control

(A) static table driven

static priority driven (20) RMS is considered a realtime scheduling algorithm

(C) dynamic planning based (D) dynamic

best effort static table driven. (B) static priority driven

(C) dynamic planning-based

(D) dynamic best effort

(21) FCFS is considered a

scheduling algorithm

(D) dynamic best effort

(A) static table driven (B) static priority driven

dynamic planning-based

(22) To meet the starting deadline and ending deadline **of** an aperiodic realtime task, the task should (A) start on or after the starting deadline and finish on or before the ending deadline

B) start on or before the starting deadline and finish on or before the ending deadline Start on or before the starting deadline and finish on or after the ending deadline C) start on or after the starting deadline and finish on or after the ending

deadline

23) To meet the starting deadline and ending deadline of a periodic **realtime task**, the task execution time should be the ending deadline minus the starting deadline

(A) equal to

(By less than or equal (C) less than

(24) In real time operating systems,

(A) realtime kernel is not required

more than or equal

task scheduling aims to schedule tasks to finish in the lowest possible time. C) tasks must be serviced by their deadlines D) all tasks should have the same priority 25) The interrupt latency should be A) maximum 26)

When the System processes data instructions without any delay is called as

A) online system (B) **real-time system** (embedded system

27) Which of the following **guarantee** correct realtime scheduling?

A) non-preemptive kernels

for real time operating systems. **minimal** (e) dependent on the scheduling

(D) zero

Dybbffline system

preemptive kernels

C) neither preemptive **nor** non-preemptive kernels (D) preemptive kernels or non preemptive kernels Suppose that we have a periodic task, T1, with an execution time 50 ms and a period 100 ms. Suppose that we have nother periodic **task**, T2, with an execution time 25 ms and a period 100 ms. Answer the questions 28 and 29) 28) The total processor utilization by the **tasks** T1 and T2 is

A) 25%

(B) 50%

- 750 = (D) 100%

29) The tasks, T1 and T2, can be scheduled correctly to meet their deadlines using

perfect scheduling only (BRMS only (C) both perfect schooling and

RMS None of the above 30) In the case of RMS, a task with the shortest period is

assigned which of the following priority? the **highest** (the lowest (C) cannot decide

due to insufficient information (D) None of the above

(31) Which of the following is NOT an example of an event in an embedded system?

(A) A button is pressed A notification message above

is received

sensor provides a certain value

None of

(32) When designing an event-driven embedded system for an AC system, it is required to update the temperature value. Which of the following design options guarantees that the AC system performs better? Include, inside an ISR, all logic required to set any new temperature value and update the LCD Using an ISR to set a bit in an event array (C) Using a key poll to set a bit in an event array (D) Both B and C

Ac

(33) When designing an event-driven embedded system for an AC system, the number of events in the system

should be

dynamic

(B) discrete

static

(D) continuous

(34) An event-driven embedded system for an AC system stores an event array which holds only one event of a supported type at the same time. This characteristic is called A Single-type support.

Singularity

4G) Singleton

(D) None of the above

(35) An ISR for an embedded system should be designed according to the following design rules.

Write interrupt handling code to be as small and as fast as possible

(B) Only perform the essential tasks that cannot be done outside the ISR

(C) Try as much as possible not to call any other outside functions in the ISR

(D) All of the above

(36) A good design for an embedded system should follow the following non-functional design principles. (A) The design should perform all required system functionalities

(B) The design should be built from one or more design patterns

The design should favor one optimization criteria over the others

(D) All of the above

(37) For any design pattern the pattern consequences describe

(A) the patterns' main problem) (B) the structure of the pattern() pattern name (D) None of the above

(38) Which of the following design patterns is considered a pattern for accessing hardware?

(A) Observer (B) Mediator) All of the above (D) None of the above

(39) In the Observer design pattern, the class which contains the actual source code required to serve requests for specific datum is

(A) AbstractClient

(B) ConcreteClient

AbstractSubject

(D) ConcreteSubject

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(40) In the Observer design pattern, the class which contains the interface required to request a specific datum

(A) AbstractClient (B) ConcreteClient

C) AbstractSubject

(D) Concrete Subject

(41) Suppose you have a set of motors that should work in a synchronized fashion to accomplish a certain task. Which of the following design patterns is more suitable to be used in the design of this system? (A)

Observer (42) The Cyclic Executive design pattern guarantees the following two conflicting objectives. (A) Fair scheduling among all realtime tasks while all tasks should meet their deadlines (B) Unfair scheduling among all realtime tasks while all tasks should **meet** their deadlines.

Fair scheduling among all realtime tasks while Not all tasks should meet their deadlines. (A) Unfair scheduling among all realtime tasks while Not all tasks should meet their deadlines, (43) The Cyclic Executive design pattern guarantees

(B) Mediator(C) Hardware Adapter (D) Hardware Proxy

(A) fast response to urgent events

C) slow response to urgent events

(B) immediate response to urgeat events (D)

undetermined response to urgent events

(44) Suppose you want to design an embedded system that should irregularly poll a set of devices. Which of the *following* design patterns is more suitable to be used in the design of this system?

(A) Interrupt Polling

(D) Both B and C

(45) The Hardware Proxy pattern provides a marshaling process as follows

The marshaling process converts

data from high level format to low level format (B) *The* marshaling process converts data from low level format to high level format (C) The marshaling process depends on the implementation of the pattern native

(D) *None of the above*

sentation-

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(46) Which of the following design patterns is

considered a **pattern that addresses concurrency?**

(A) Semaphore (B) Synchronization (C) Polling

None of the above

is a that addresses resource management?

(A) Mediator (B) Cyclic Executive (C)

Resource Sharing Critical Region

(48) Which of the following design patterns is considered a pattern **that** addresses safety and **reliability?**

CFAll of the above (D) None of the above

Cyclic Executive Critical Region

Consider the following inequality used by the Cyclic Executive pattern to schedule a tasks.

$$D_i + 2 \sum C_j + K$$

case execution time for task j

(49) The parameter C, in the above inequality represents the
(A) best

Taverage (C) worst

(50) The parameter K in the above inequality represents the cyclic executive loop overhead including (A) task invocation overhead
(C) task return overhead

(E)) burst

task processing overhead

(D)) Both A and C

(51) The parameter D, in the above inequality represents the

(starting deadline for task i (B) ending deadline for task (C) Any of the above

(D) None of the above (52) The unbounded priority inversion problem is completely avoided when using the

A) Mediator (B) Observer Cyclic Executive

DrCritical Region

(53) The unbounded blocking problem is completely avoided when using the

(A) Polling (54) The Cyclic

Executive pattern applies the AEarliest deadline first

design pattern

design pattern the

Interrupt (C) Cyclic

Executive

(D) Critical Region
scheduling algorithm

Round Robin

None of the above

(B) RMS

(55) The Cyclic Executive pattern has a timer that controls the

(A) time allocated to the whole cycle in which all tasks are executed %

(B) time slot allocated to each task in the whole cycle of tasks 7

(C) time required to context switch from one task to another y
time required to process each task executed in the cycle

(56) Suppose you have three periodic tasks, T1, T2 and T3. T1 has an instance that occurs every 1 ms. T2 has an instance that occurs every 2 ms. T3 has an instance that occurs every 3 ms. Which task has a higher rate?
JATTI

(B) T2

(GT)

(D) All tasks have same rate

(57) Suppose you have three periodic tasks, T1, T2 and T3. T1 has an instance that occurs every 1 ms. T2 has 12 instances each of them occurs every 1 ms. T3 has 13 instances each of them occurs every 1 ms. Which task has higher rate? (A) T1

(B) T2

(C) T3

20 All

All tasks have same rate

(58) Suppose you have three periodic tasks, T1, T2 and T3. T1 has an instance that executes in 1 ms. T2 has an instance that executes in 2 ms. T3 has an instance that executes in 3 ms. Which task has a higher rate? ATTE

(D) cannot decide due to insufficient

information 59) Which of the following is NOT an example of a trigger in an embedded system?

(B) T2

A) A LED blinks every 1 ms

(C) T3

A notification message is received 2 ms after a button is pressed u A motor arm rotates after a button is pressed (B) None of the above

60) The Hardware Adapter pattern converts solves the following problem. A) It

converts between two hardware interfaces

It adapts an existing hardware interface to work well with an

existing application It converts between a hardware interface and a software interface

Both A and B X