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OLABISI ONABANJO UNIVERSITY
COLLEGE OF ENGINEERING AND ENVIRONMENTAL STUDIES
FACULTY OF ENGINEERING
DEPARTMENT OF COMPUTER ENGINEERING
HARMATTAN SEMESTER EXAMINATION (2020/2021 SESSION)

COURSE TITLE: REAL-TIME SYSTEM

COURSE CODE: CPE 507

TIME ALLOWED: 2 hours

COURSE UNIT: 2

INSTRUCTION: Answer QUESTION ONE (1) AND ANY OTHER TWO (2)

Question One

- (a) State whether the following statements to be TRUE or FALSE. Justify your answer in each case.
- A hard real-time application is made up of only hard real time tasks
 - Hardware fault-tolerance techniques cannot be easily adapted to provide software fault-tolerance.
 - Performance constraints on a real-time system ensure that the environment of the system is well-behaved
 - Soft real-time tasks are those which do not have any time bounds associated with them
 - A deadline constraint between two response event can be considered to be a performance constraint on the environment of the system. (10mks, 2mks each)
- (b) Explain why hardware fault-tolerance is easier to achieve compared to software fault Tolerance (5mks)
- (c) Identify the difference between a Delay and Duration constraints, support your claim with examples. (7mks)
- (d) (i) What is a safety-critical system?
(ii) Give two practical examples of safety-critical hard real- time systems? (8mks)

Question Two

- (a) (i) Explain what is meant by the term "Real-Time"?
(ii) How is the concept of real-time different from the traditional notion of time? Explain your answer using a suitable example (8mks)
- (b) Briefly explain five (5) characteristics of Real-Time Systems (5mks)
- (c) Is it possible to have an extremely safe but unreliable system? If your answer is affirmative, then give an example of such a system. If not, justify why it is not possible for such a system to exist. (7mks)

Question Three

- (a) How do the following factors affect the Reliability of a system? (8mks)
- Cost
 - Performance
 - Time of Development
 - Risk of failure
- (b) In a real-time system, raw sensor signals need to be preprocessed before they can be used by a computer. (i) Why is it necessary to preprocess the raw sensor signals before they can be used by a computer?
(ii) Explain the different types of preprocessing that are normally carried out on sensor signals to make them suitable to be directly used by a computer. (8mks)
- (c) Using the example of a durational constraint, show the Extended Finite State Machine (EFSM) model? (4mks)

Question Four

- (a) With the aid of a schematic diagram, explain the concept of the bath-tub curve and what it represents? (6mks)
- (b) What are the four factors responsible for the initial high failure rate during the infant mortality stage of the bath-tub curve? (5mks)
- (c) Real time Systems have of late found application in wide ranging areas. Enumerate six application areas with an example in each case. (9mks)

Question Five

- (a) Using a block diagram, show the important hardware components of a Real-Time System as represented by the Model of a Real-Time System. Explain the roles of the different components. (6mks)
- (b) What is the major difference between a performance constraint and behavioural constraint? (4mks)
- (c) List five (5) statistical distributions used to model Reliability of a system, hence determine the reliability of a system after 4hrs having 1000 components initially with 1% failure rate using both manual and exponential distribution methods (10mks)