4DV608

Assignment 1

Dependability Engineering

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Exercise 1

An Internet server provided by an ISP with thousands of customers

- *Availability*: Due to thousands of customers, availability is the most critical dependability attribute. It is very important that server should be up and running when requested. However, the availability of the server is directly dependent on the availability of its ISP.

- *Security*: To maintain the availability attribute, it is important that server should secure itself against accidental or intentional attacks. Hence, security is the other most critical dependability attribute.

A computer-controlled scalpel used in keyhole surgery

- *Safety*: Due to the involvement of human life, safety is the most critical dependability attribute. It is very important that computer-controlled scalpel should not cause harm to the people, e.g., doctors, patients, etc.

- *Reliability*: To maintain the safety attribute, it is important that computer-controlled scalpel should work according to the specification. Hence, reliability is the other most critical dependability attribute.

A directional control system used in a satellite launch vehicle

- *Safety*: Satellite launch vehicles are safety critical systems. Therefore, safety is the most critical dependability attribute. It is very important that directional control system should not fail while operating because it can cause harm to environment or people.

- *Reliability*: To maintain the safety attribute, it is important that directional control system should work according to the specification. Hence, reliability is the other most critical dependability attribute.

An Internet-based personal finance management system

- *Security*: Businesses related to finance should be very secure. Therefore, security is the most critical dependability attribute.

Exercise 2

A system that monitors patients in a hospital intensive care unit

- *Usage*: Monitoring patients continuously leads to high usage.

- *Reliability Metrics*:

    - *AVAIL*: High usage requires high availability. Therefore, AVAIL is appropriated to find the availability of this system. It is hard to predict the value of AVAIL because it directly depends on the health of a patient. For instance, the availability the system can be 0.99999 for patients with poor health, whereas it can be 0.999 or 0.9999 for patients with not so poor health.

    - *Rate of Occurrence of Failures (ROCOF)*: Due to high number demands, it is very important for this system to prevent failure. Therefore, ROCOF is appropriated to find the probability of failure in a given time. The value of ROCOF should be 0.000001 because human life is involved.

A word processor

- *Usage*: On demand.

- *Reliability Metric*:

    - *ROCOF*: Word processor should operate without frequent failures. ROCOF is appropriated to find the probability of failure in a given time. As word processor is not highly dependable system, the value of ROCOF can be 0.001.

An automated vending machine control system

- *Usage*: On demand.

- *Reliability Metric*:

    - *Probability of Failure on Demand (POFD)*: Due to on demand usage, POFOD is appropriated to find the probability of failure when a demand is made. Automated vending machine should have some level of dependability. Otherwise, it may be unable to deliver services. Here, failures do not cause threat to human life. Rather, it is related to business loss. Therefore, the value of POFD can be 0.0001.

A system to control braking in a car

- *Usage*: On demand.

- *Reliability Metric*:

    - *POFD*: Due to on demand usage, POFOD is appropriated to find the probability of failure when a demand is made. This is a safety critical system because human lives are involved. Therefore, the value of POFD should be 0.000001.

A system to control a refrigeration unit

- *Usage*: ~ 24 hours

- *Reliability Metrics*:

    - *AVAIL*: High usage requires high availability. Therefore, AVAIL is appropriated to find the availability of this system. The value of AVIAL can be 0.9999. Otherwise, it may be unable to deliver services

    - *ROCOF*: This system should operate without failures. Infrequent failures can be accepted as it is not a life critical system. ROCOF is appropriated to find the probability of failure in a given time. The value of ROCOF can be 0.00001.

A management report generator

- *Usage*: On demand during working hours

- *Reliability Metric*:

    - *POFD*: Due to on demand usage, POFOD is appropriated to find the probability of failure when a demand is made. The value of POFD can be 0.0001 because it is not a life critical system. Moreover, people are ready to tolerate some failures.

Exercise 3

1. Onboard system should monitor the location of the train
2. Onboard system should monitor the speed of the train
3. Onboard system should know the destination of the train
4. Onboard system should know the route(s) to the destination of the train
5. Onboard system should know the distance to the destination of the train
6. Onboard system should know the distance to next segment of track
7. Onboard system should know the traffic on the current segment of track
8. Onboard system should know the traffic on the next segment of track