Started on	Tuesday, 5 August 2025, 8:21 PM
State	Finished
Completed on	Thursday, 28 August 2025, 5:00 PM
Time taken	22 days 20 hours

Question 1

Complete

Not graded

Define (a) failure rate, and (b) hazard rate. Discuss the plausibility of the “bathtub curve” in both contexts.

Failure rate = The number of failures per unit of time over a population of items (group)

Hazard Rate = The instantaneous conditional failure probability for a single item, given that it has survived up till time (t)

Bathtub Curve = the shape of the curve of failure or hazard rate with respect to time [3 phases: 1) infant mortality 2) Useful Life 3) Wear-out Period]

(a) failure rate: (p.10, line 23)

(b) hazard rate: (p.40, line 24)

Discuss the plausibility of the “bathtub curve” in both contexts: p.43, section 3.3.3.

Question 2

Complete

Not graded

Explain the theory of component failures derived from the interaction of stress (or load) and strength distributions.

A component will fail when the applied stress/load exceeds it inherent strength

p.8, line 10-

Question 3

Complete

Not graded

What are the main objectives of a reliability engineering team working on an engineering development project? Describe the important skills and experience that should be available within the team.

The teams job is to make sure that the product meets or surpasses the reliability requirements. It will perform its intended function without failure for a specific period.

Objectives: Define reliability Requirements, Plan Reliability Activities, Identify & Manage Reliability Risks, Support Design for Reliability, Reliability Modelling & Prediction, Plan & oversee reliability testing

The important skills the teams needs are with respect to knwing reliability engineering methods, statistical analysis & data modelling, Test planning & environmental simulation, Systems engineering knowledge, Materials & mechanical/electrical engineering

Main objectives: p.5, line 27-

Important skills: p.5, line 35-

Question 4

Complete

Not graded

It is sometimes claimed that increasing quality and reliability beyond levels that have been achieved in the past is likely to be uneconomic, due to the costs of the actions that would be necessary. Present the argument against this belief. Illustrate it with an example from your own experience.

The important points to mention with regards to providing an alternative view to this would include:

- A product with a higher reliabilyt can have a lower TCO

-Failures are detrimental to brand value which could have long term negative financial effects on the business

-Improvements in reliabilty can result in imporvements of process which can often mean better efficiency...

p.13, section 1.6, also p.16, lines 1-6

Question 5

Complete

Not graded

Describe the difference between repairable and non-repairable items. What kind of effect might this difference have on reliability? List examples of repairable and non-repairable items in your everyday life.

Repairable items can be restored after failure whereas non repairabale are discarded

Repairable items can sustain long service lives with proper maintenance, but their reliability curves often reset after repair. Non-repairable items require high inherent reliability from the start, since they get no “second chance.”

Repairable: Cars, laptop, refridgerator,

Non-repairable: lightbulbs, fuses

p.40, section 3.2

Question 6

Complete

Not graded

Explain the difference between reliability and durability and how they can be specified in a product development programme.

Reliability is the probabilty that an asset will perform its intended function without failure for a specifc period and durability is the ability for it to withstand wear, fatigue, corrosion etc...

p.5, line 17-26

Question 7

Complete

Not graded

List the potential economic outcomes of poor reliability, and identify which costs are directly quantifiable and which are intangible. Explain how they can be minimised, and discuss the extent to which very high reliability (approaching zero failures) is achievable in practice.

Quantifiable: warranty & returns, field service, production downtime, inspection escalation

Indirect: Lost sales, employee morale

Set clear reliability requirements, Design-for-Reliability, Supplier quality, Design verification by statistics, Process capability & control

Potential (quantifiable) outcomes of poor reliability include high warranty and service cost, product recalls, loss of sales, and potential product liability and litigation.

Intangible losses include poor company reputation, loss of future business, damaged relations with customers and suppliers.

Major contributors to the cost of the quality and reliability programme include design analysis such as FMECA, reliability test and demonstration, and FRACAS. The ways to reduce those cost factors would include various cost reduction and efficiency improvement tools such as design for reliability, design for six sigma, process optimization, lean manufacturing and others. The emphasis should be on optimization, rather than reduction.

Question 8

Not answered

Not graded

After processing the existing programme cost data and running a regression model on the preview, projects, the cost of product development and manufacturing (CDM) has been estimated to follow the equation: CDM = $0.8 million + $3.83 million x R^2 (R is the achieved product reliability at service life and is expected to be above 90%). The cost of failure (CF) has been estimated as the sum of fixed cost of $40 000 plus variable cost of $150 per failure. The total number of the expected failures is n x (1 - R), where n is the total number of produced units. Considering that the production volume is expected to be 50 000 units, estimate the optimal target reliability and the total cost of the programme.

Total Cost = 800 000 + 3 830 000R^2 + 40 000 + 150n (1 - R)

n = 50 000

To minimize the cost function we need to find its first derivative with respect to the reliability and set it equal to zero (feel free to recap on your differentiation rules HERE):

d(Total Cost) / dR = 2 * 3 830 000R - 150 * 50 000 = 0

Solving R, produces R = 0.979

The associated total cost is: cost = $4 668 329.03

Question 9

Correct

Not graded

Which item does not fit?

Select one:

- a. Engineering knowledge
- b. Durability
- c. Reliability data analysis methods
- d. Failure causes
- e. Cope with failure

Your answer is correct.

The correct answer is: Durability

Question 10

Correct

Not graded

Which item does not fit?

Select one:

- a. Variation
- b. Wear-out
- c. Excessive stress
- d. Durability
- e. Incapable design

Your answer is correct.

The correct answer is: Durability

Jump to...

< Previous Activity

Next Section >