Question Paper

Exam Date & Time: 27-Dec-2022 (02:30 PM - 05:30 PM)

MANIPAL ACADEMY OF HIGHER EDUCATION

VII SEMESTER B.TECH (IT/CCE) MAKE-UP EXAMINATIONS, DEC 2022

Software Reliability [ICT 4055]

Marks: 50 **Duration: 180 mins.**

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Answer all the questions.

Instructions to Candidates: Answer ALL questions Missing data may be suitably assumed

1) A) A prediction system A in which the mean time to next failure (based on the exponential model) will be the average of the 2 previously observed failure times. Apply this prediction system to the data given in Table 1. Generate the predictions for i values from 1 to 10. Repeat the procedure for system B in which the mean time to next failure will be the average of the 3 previously observed failure times. Using prequential method compute PL(A)/PL(B), showing steps of calculation. Tabulate the results for i=1 to 10, as i, t_i, T_i, λ_i, $f_i(t_i)$, PL(A), PL(B) and PL(A)/PL(B). (5)

Table 1. Failure time Data

Failure no	1	2	3	4	5	6	7	8	9	10
Execution time between successive failures in secs	32	4	2	8	225	162	76	58	57	200

B) "A good design should exhibit high module cohesion and low module coupling". Justify with an example for each. (3)

C) Suppose 25 devices are tested for 500hrs. During the test, 2 failures occur. Calculate MTBF, MTTF and probability that one particular device will be operational at time equal to MTBF. (2)

2) A) Develop an operational Profile for Mess billing system. It is observed that it takes 1hr to design and run one test, 2% of the tests reveal faults, takes 3hrs to correct each fault. The total testing time allocated is 700hrs. From this information find the total number of tests to be performed and also, the number of tests required to test each feature specified in the operational profile. (5)

B) What is the significance of reliability testing in prediction analysis? Explain regression testing used in improving reliability. (3)

C) What are internal and external product attributes? Explain the use of McCabe's cyclomatic complexity number in software metric with a suitable example. (2)

3) A) Assume that a program will experience 100 failures in infinite time. The initial failure intensity was 10 failures/CPU-hr, the present failure intensity is 3.68 failures/CPU-hour and objective intensity is 0.000252 failure/CPU-hr. Predict the additional testing time to achieve the stated objective. Also, compare and contrast Musa's basic exponential model and Musa-Okumoto models of reliability. (5)

B) Construct a simple Goal Question Metric(GQM) tree corresponding to the producer's goal of improving the quality of the software. Also, list out the advantages of using this metric in software reliability measurement. (3)

C) An electrical supply system is subject to failure which causes loss of supply to the consumer. The mean time between such failures is known to be 398hr and the mean time to repair the failures and restore the supply is known to be 2 hr. What is the average value of the availability of the supply to the consumer over a long period of time? (2)

4) Compute both the unadjusted and adjusted function-point count (assign the scale between 0 to 5 as irrelevant-0, essential-5) for the following scenario. State any assumptions made. (5)

A) Development of a network system which allows customers to report bugs in a product. These reports will be stored in a file and developers will receive a daily report with new bugs which they need to solve. Customers will also receive a daily status report for bugs which they submitted. Management can query the system for a summary info of particular months.

B) Specify any three methods to improve prediction accuracy. (3)

C) Specify any two measures of availability. Given exponential failure rates and repair rates of **lamda = 2,** mu **= 4,** determine the instantaneous availability at 0.2 hours. (2)

5) Write the ISO 9126 evaluation process model used in modelling software quality. Illustrate defect density and usability measures used to measure the quality with an example. (5)

A)

B) Compare between hardware reliability and software reliability. A system has a mean time between maintenance action (MTBMA) of 100 hours, a F_c of ½, a F_p of 1 and M_{CT} of 2 hours and M_{PT} of 2 hour (F_c = no. of corrective actions/1000 hrs, F_p = no. of preventive actions/1000 hrs, M_{CT} and M_{PT} are mean active time for corrective and preventive maintenance respectively). What is achieved availability A_A? (3)

C) Differentiate between cohesion and coupling. How does these impact on software reliability measurements? (2)

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