Question Paper

Exam Date & Time: 17-Nov-2022 (09:00 AM - 12:00 PM)

MANIPAL ACADEMY OF HIGHER EDUCATION

VII SEMESTER B.TECH(IT/CCE) END SEMESTER EXAMINATIONS, NOV 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 crude 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 the prediction system to the successive failure time data given in Table 1. Generate the predictions. 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. Determine the ui values, find the Kolmogorov distance and check the validity. (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	36	4	0	8	227	65	176	58	457	300

Which system is preferred A or B? Justify your answer.

B) Mention three basic approaches used for reliability testing. Use the data on failure time and no. of failures as given in Table 2. (3)

Table 2. Failure Data

Time	No. of. Failures
2	12
8	30
15	42
23	52
33	70

Calculate the Karl Pearson coefficient and Spearman's coefficient to find correlation.

C) A commonly-used software quality measure in industry is the number of known errors per thousand lines of product source code. Compare the usefulness of this measure for developers and users. What are the possible problems with relying on this measure as the sole expression of software quality? (2)

2) A) Develop an operational Profile for Library Module. It is observed that it takes 1hr to design and run one test, 3% of the tests reveal faults, takes 2hrs to correct each fault. The total testing time allocated is 500hrs. From this information find the total number of tests to be performed and also number of tests required to test each feature specified in the operational profile. (5)

B) Compare Musa's basic exponential model and logarithmic model. A program will experience 250 failures in infinite time. It has now experienced 40 failures. The initial failure intensity was 10 failures/cpu hour, failure intensity decay parameter (theta) = 0.03/failure. Calculate current failure intensity, and no.of failures after 10 cpu hrs and 100 cpu hrs for both the models. (3)

C) Consider the code snippet, draw control flow graph and find the McCabe's cyclomatic complexity. (2)

```
#include< stdio.h>

main()

{

int a ;

scanf ("%d", &a);

if ( a < = 700)

if ( a > 200 ) printf ("200 < a< 700 %dn" , a);

else printf ("a < = 200 %dn" , a);

else printf ("a >= 700 %dn" , a);}
```

How this is useful in measuring software reliability measurement?

3) Data recorded show that there are 5 observations corresponding to times between testing: 12, 24, 36, 48, 60 (in months). The total expected defects in the code are 150. The defect reduction rate is considered to be 0.03. Explain in detail steps how Goel-Okumoto basic execution model can be used to find the no. of defects predicted at time t, the total number of residual errors and the reliability factor for all the 5 observations, show the calculation steps and the results in a tabular form. How is Goel-Okumoto basic execution Model different from Musa-Okumoto model? (5)

A)

B) Construct a simple Goal Question Metric(GQM) tree corresponding to the producer's goal of improving the maintainability of the software. Explain how Goal Question Metric (GQM) is used in software measurement? (3)

C) In a system, if average number of errors detected at time t is 55 and 50 as predicted by a model. It is observed that at the end of testing the total number of errors were 60 and as predicted by the model was 50. Calculate SRE (Short-term Relative Error) and MRE (Mean Relative Error). (2)

4) Find the adjusted (assign the scale irrelevant-0, essential-5) and unadjusted function point count for the following scenario: (5)

A)

Consider a Library module takes book details from publishers and stores them in a catalogue of books. User have an interface to browse through the library catalogue and choose the book. A report on total number of books procured, removed from the list and missing books will be generated. Users can put a query for availability of book for issue. Also, list the advantages of using function point count.

B) Apply risk analysis on online shopping tool and create a risk matrix. Calculate risk factor if a software has 85% complexity and severity index value is 0.90. (3)

C) Justify the significance of state hierarchy model (SHY) with respect to the usage of on-line learning tool. (2)

5) Write McCall's triangle of quality used in modelling software quality. Illustrate by making a checklist of measurement factors (accuracy, error tolerance, consistency and simplicity) that apply to requirements, design and implementation to measure the reliability. (5)

A)

B) A laptop manufacturer determines that his laptop has a constant failure rate =0.3/year in normal use. For how long should the warranty be set if no more that 5% of the computers are to be (3)

returned to the manufacturer for repair? Also, compare between debugging and software testing.

C) What are the factors that impact software reliability? The data show that 420 items failed during a test with a total operating time of 1 million hours. Find failure rate and the reliability of the product after 100hrs. (2)

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