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Testing and Dependability: Exercise Sheet 1

Notes: Enter your name, student ID number, and degree program in the table below, and write your student ID number on each additional sheet you submit. If you use equations from the lecture, please include the equation numbers in your work. Write your solutions on the answer sheets as much as possible.

Name	Student ID Number	Degree Program	Points from11

Exercise 1.1: Please answer only in brief bullet points:

a) Which threats do we distinguish for IT systems during operation (2 shortcuts, each consisting of 2 letters)? 0,5P

b) What are the three levels at which dependability is ensured (3 bullet points)? 0,5P

c) What types of responses to a service request does our service model distinguish (a tree-like classification consisting of 5 abbreviations, each 2 to 3 letters long)?? 0,5P

d) If testing is so expensive, why not just do without it? 0,5P

Exercise 1.2: A count value A is a count value for B with a frequency of $h_1 = 10\%$ and a count value for C otherwise. A count value B is a count value for C with a frequency of $h_2 = 20\%$ and a count value for D otherwise.

a) Draw the count-value assignment graph. 1P

b) With what frequency

$$h_{\mathrm{C}} = \frac{C}{A}\Big|_{\mathrm{SLC}}$$

is count value A also a count value for C? 1P

Exercise 1.3: A printing service has a performance rate of $\eta_{\mathrm{DS}} = 99\%$, a service availability of $A_{\mathrm{S}} = 98\%$, and the printer hardware fails on average every 20,000 hours (approximately 2 years), requiring repair. Required total availability $A \geq 96\%$.

a) What is the minimum required hardware availability A_{H}? 1P

b) What is the maximum allowable average repair time for the hardware? 1P

Exercise 1.4: In a computer system with an average service time of $\bar{t}_S = 5\,\text{min}$ and a system utilization rate of $\eta_{SS} = 40\%$, within 10,000 h of operation, 100 malfunctions occurred due to interferences, 200 malfunctions due to operator errors, and 500 malfunctions due to undetected faults. Of all malfunctions, MC = 90\ % are detected, and of the undetected malfunctions, a proportion of $\rho = 1\%$ poses a safety hazard.

a) What is the expected number of delivered services, μ_{DS}, within 10,000 operating hours? 1P

b) What are the rates of

- malfunctions that occur,
- undetected malfunctions, and
- malfunctions that pose a safety risk,

both individually and in total (fill in the table)? 3P

	with regard to undetected malfunctions	Operational error	Faults	in total
MF	$\zeta_D =$	$\zeta_U =$	$\zeta_F =$	$\zeta =$
NDM	$\zeta_{ND.D} =$	$\zeta_{ND.U} =$	$\zeta_{ND.F} =$	$\zeta_{ND} =$
SP	$\zeta_{S.NDM.D} =$	$\zeta_{S.NDM.U} =$	$\zeta_{S.NDM.F} =$	$\zeta_{S.NDM} =$

(MF: malfunctions that occur; NDM: malfunctions that go undetected; SP: malfunctions that go undetected and pose a safety risk, D disruption (interference), U operational error by user, F faults).

c) What are the reliability R and safety S if a safe state is established for all detected problems? 1P

Use the symbols provided in the exercise. In the lecture, similar problems are covered, some of which use only partially similar symbols.