

ECSE-4963: Experimental Networking

Exam 1

Time: **75 min (strictly enforced)**

Points: **50**

YOUR NAME:

*Be brief, but **DO NOT** omit necessary detail*

{Note: Simply copying text directly from the slides or notes will not earn (partial) credit. Brief, clear and consistent explanation will.}

1. **[12 pts] {Use of a spreadsheet is OK}**

Given: $n=7$ random RTT samples (in ms):

$\{37, 26, 29, 42, 38, 25, 100\}$

- **[7 points]** Find: sample mean (\bar{x}), sample standard deviation (s), 90% confidence interval (CI) & 95% CI for the *population* mean.
- **[5 points]** Discuss the impact of the outlier on the confidence intervals after you re-compute the 95% CI if the outlier value 100 were 35 instead.

2. [13 pts] **BRIEFLY**, what is the difference between:

- a) “normal quartile-quartile plot” vs “scatter plot” [2 pts]
- b) “CDF” vs “CCDF” [2 pts]
- c) “bernoulli r.v.” vs “binomial r.v.” [2 pts]
- d) “R-squared” vs “SST” vs variance [2 pts]

Explain succinctly: [5 pts]

- i) What is a sampling distribution and central limit theorem? What are its important implications for statistical inference? [2.5 pts]
- ii) Explain the connection between regression and experiment design? How is experiment design related to Amdahl’s law in the design process? [2.5 pts]

II. [10 pts] Experiment Design: Analyze the 2³ design

- Quantify all the main effects and all interactions [4 pts]
- Quantify percentages of variations explained. [3 pts]
- Sort the variables in the order of decreasing importance. Interpret the result and the implications for potential design changes. [3 pts]

	A1		A2	
	C1	C2	C1	C2
B1	150	40	95	50
B2	30	20	30	35

- I. [15 pts] **DESIGN WALK-THROUGH:** We learnt about animation, simulation (ns-2), and graphing, tracing/profiling and experiment design. Assume that you are given a novel design for TCP that improves **BOTH** its congestion control (by changing the increase/decrease algorithm) and its reliability mechanisms (eg: by adding forward error correction in addition to regular retransmissions).
- II. **What** are the “parameters” and “metrics” (and graphs) you would use to study if this design “improvement” is indeed a wise one? Argue **why** your set of metrics and parameters is a complete and meaningful set. How would you interpret your metrics/graphs to disentangle the reliability issues from the congestion control issues? [6 pts]
- III. What set of workloads would you use to test such a system & explain why they are meaningful, and helps you make quick progress in your evaluation process. [4 pts]
- IV. Walk me through how you would systematically use the above tools (in the right sequence) to pinpoint problems and incrementally refine your design. What are the pluses & minuses of each technique? [5 pts]

