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 (xbar), 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 2^3 design**

a) Quantify all the main effects and all interactions [4 pts]

b) Quantify percentages of variations explained. [3 pts]

c) Sort the variables in the order of decreasing importance. Interpret the result and the implications for potential design changes. [3 pts]

<table>
<thead>
<tr>
<th></th>
<th>A1</th>
<th>A2</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>C1</td>
<td>C2</td>
</tr>
<tr>
<td>B1</td>
<td>150</td>
<td>40</td>
</tr>
<tr>
<td></td>
<td>95</td>
<td>50</td>
</tr>
<tr>
<td>B2</td>
<td>30</td>
<td>20</td>
</tr>
<tr>
<td></td>
<td>30</td>
<td>35</td>
</tr>
</tbody>
</table>

Rensselaer Polytechnic Institute

Shivkumar Kalyanaraman
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]