Follow the instructions below:

1. The exam must be solved individually.

2. Submitting materials retrieved from the internet is plagiarism.

3. Solutions must be in a Jupyter notebook, with a Julia kernel.

4. You may use all Julia code posted on the course web site and your own code.

5. The questions are provided in a Jupyter notebook.
   You may use that notebook to formulate your answers to the questions.

6. Answers must be submitted before, or at the latest at 12:50pm.

7. Submit to gradescope.

8. Answers submitted before noon on Wednesday 4 March will receive homework credit.

9. Every question is worth the same amount of points.

10. During the exam no questions will be answered, so do not ask questions.

Good Luck!

1. It costs \$100 to produce an item. If the production misses the target of 20 with a deviation of 3 or more, then the item must be discarded.

   (a) Define the quality loss function.

   (b) Compute the expected loss for the current production mean of 19 and deviation 2.

   (c) Suppose we want to reduce the deviation of the production to 1.
       How much extra cost may this reduction add?

2. Give the transfer function of a filter to remove a signal at 40 Hz, sampled at 320 Hz.

   (a) Justify the design of your filter.

   (b) Which signals are also removed by your filter? Interpret the Bode plot.

3. A plywood manufacturer offers four types of plywood, distinguished as grades A, B, C, and D, with revenues \$25, \$12, \$9, and \$4 respectively.

   - Upper limits on production are $1000/3$ for A and D; and $1500/3$ for B and C.

   - In 8 hours, a laborer can produce at most $1/25$-th units of A and B and $1/30$-th units of C and D.

   - The manufacturer needs to offer 40% of grade A and B, and 60% of grade C and D.

   Formulate the optimization problem to maximize revenue, subject to the constraints.

4. Choose between two payout plans for a sum of p dollars: (1) either you receive 90% of p now; or (2) $p/12$ now, followed by 11 monthly installments of $p/12$.

   What should the interest rate be to break even? Justify your answer.

5. Describe in one paragraph what you learned from _another_ project presentation.