

Mini-Exam

MAA-C3001 Statistical and Stochastic Methods in Engineering

23.10.2017

1 Hypothesis testing (1 pt)

1. Explain null hypothesis, alternative hypothesis, significance level, errors of the first and second kind, and power of a test.
2. Philosophize a little about how you would choose the significance level in any concrete situation where you use statistical hypothesis testing.

2 Decision making under uncertainty (1 pt)

What is a utility function? What is a convex utility function and what kind of behaviour does it describe? What is a concave utility function and what does it describe? Draw examples!

3 Stochastic processes (1 pt)

1. Explain the concepts of stationary and ergodic processes in the theory of random environmental loads. Use drawings.
2. For spatial stochastic processes, what is homogeneity? What is isotropy?

4 Cumulative probability distributions (1 pt)

You have collected observations of ship velocities and divided them into categories or "bins" according to the table below:

Velocity range (knots)	Number observed	Relative frequency	Cumulative frequency
3 – 5	39	–	–
5 – 7	13	–	–
7 – 9	26	–	–
9 – 11	39	–	–
11 – 13	13	–	–

1. Fill in the missing values, i.e. calculate the relative frequency (i.e. a probability between 0 – 1) as well as the cumulative frequency for each of the velocity range categories in the table.
2. Based on the relative frequencies, draw an empirical cumulative distribution function of the velocity of vessels on paper. Remember to indicate units on the axes of your drawing.
3. Having access to a computer with Matlab and a random-number generating function, how would you generate any number of ship velocities randomly drawn from a distribution indistinguishable from the above empirical one? Just explain the concept.

Mini-exam and course grading:

- points from the mini-exam (above, max 4) are added to
- points from the exercises: 0 - 2 bonus points for 50% - 100% of the exercises, linearly. Minimum 50% is required
- 1-6 are passing grades, both for mini-exam and course.