MAT4010 Pretest Probability

Helmer Aslaksen

Dept. of Teacher Education/Dept. of Mathematics

University of Oslo

helmer.aslaksen@gmail.com

The goal of this pretest is to make you think about some questions related to "school mathematics from an advanced viewpoint". You will discuss these questions in breakout rooms at the beginning of class. This will both force you to reflect about your understanding of these topics, and help me gauge your understanding.

When we finish this part of the course, your homework will be to both write up the answers to the questions, and to answer some questions about the relationship between these questions and school mathematics. All the questions will be discussed in the lectures, but writing up the answers will be a good way for you to review.

You will not be marked on this test, and you can work on it in groups. You can either submit based on the breakout groups or groups of 1–4 people that you form yourself. These pretest-homeworks constitute the "oblig" part of the course, and must be submitted in order to take the exam.

1 Before the Lectures

1.1. You know that I have two children. I can either have two boys, two girls or one of each. I then use the rule that says that the probability is favorable over possible, so the probability of one of each is $1/3$. Why is that not correct?

1.2. You roll two identical D6 dice at the same time.

   (a) How many possible outcomes are there?

   (b) Are you more likely to get a 1 and a 6, or 6 twice?

1.3. Imagine a society that has a cultural preference for boys, and suppose all families continue having babies until they get a boy, at which time they stop. Suppose for simplicity that you are not allowed to have more than 4 children. (This last condition is actually not significant.) In this society, will there be

(a) More boys that girls?

(b) More girls than boys?

(c) Equally many boys and girls?

1.4. The South African mathematician John Kerrich was interned in a prison camp in Denmark during WWII. To pass the time, he carried out probability experiments. He tossed a coin 10,000 times, and got 5067 heads.

(a) What is frequency and what is relative frequency?

(b) What does the Law of Large Numbers say?

(c) How likely do you think it would be to get a result that is 67 more away from the expected value?

1.5. Can you explain the Monty Hall Problem about the car and the goats behind the three doors? You are a contestant on a TV game show faced with three doors. There is a car behind one door and a goat behind each of the two other. You pick one door, and instead of opening it, the host opens another door with a goat behind it and asks if you want to switch. Should you switch or stick with your first guess?

1.6. There are two formulas for computing the variance, the sample variance $\frac{1}{n-1}\sum_{i=1}^{n}(X_i - \overline{X})^2$ and the population variance $\frac{1}{n}\sum_{i=1}^{n}(X_i - \mathrm{E}(X))^2$. When do you use them?

2   Homework after the lectures

2.1. Write up answers to the questions above.

2.2. Was there anything in this chapter that you had heard about before, but not really understood or not known why it was true?

2.3. Was there anything in this chapter that you enjoyed learning about?

2.4. Was there anything in this chapter that changed the way you look at this topic?

2.5. Was there anything in this chapter that you think you will use in your teaching or that will influence your teaching, either directly or indirectly?

2.6. Which of the questions above do you think are likely to come up in your teaching and in which situations? Do you think they will come up often? Do you think they will come from strong students, average students or weak students?

2.7. Name three additional situations where the material in this chapter could be useful for your teaching, either directly or indirectly? For instance when planning your teaching, responding to questions, clarifying your own understanding or other situations.

2.8. Can you imagine other questions that students might ask? Were there other questions related to these topics that you wondered about when you were in school?