5. Exercise: CLT applicability

Exercises due May 1, 2020 05:29 IST *Completed*

Exercise: CLT applicability

4/4 points (graded)

Consider the class average in an exam in a few different settings. In all cases, assume that we have a large class consisting of equally well-prepared students. Think about the assumptions behind the central limit theorem, and choose the most appropriate response under the given description of the different settings.

1. Consider the class average in an exam of a fixed difficulty.

- (●) The class average is approximately normal
- ( ) The class average is not approximately normal because the student scores are strongly dependent
- ( ) The class average is not approximately normal because the student scores are not identically distributed

✔

2. Consider the class average in an exam that is equally likely to be very easy or very hard.

- ( ) The class average is approximately normal
- (●) The class average is not approximately normal because the student scores are strongly dependent

- ◯ The class average is not approximately normal because the student scores are not identically distributed

✔

3. Consider the class average if the class is split into two equal-size sections. One section gets an easy exam and the other section gets a hard exam.

- ◉ The class average is approximately normal
- ◯ The class average is not approximately normal because the student scores are strongly dependent
- ◯ The class average is not approximately normal because the student scores are not identically distributed

✔

4. Consider the class average if every student is (randomly and independently) given either an easy or a hard exam.

- ◉ The class average is approximately normal
- ◯ The class average is not approximately normal because the student scores are strongly dependent
- ◯ The class average is not approximately normal because the student scores are not identically distributed

✔

Solution:

1. Since students are equally well-prepared and the difficulty level is fixed, the only randomness in a student's score comes from luck or accidental mistakes of that student. It is then plausible to assume that each student's score will be an independent random variable drawn from the same distribution, and the CLT applies.

2. Here, the score of each student depends strongly on the difficulty level of the exam, which is random but common for all students. This creates a strong dependence between the student scores, and the CLT does not apply.

3. This is more subtle. The scores of the different students are not identically distributed. However, let Y_i be the score of the ith student from the first section and let Z_i be the score of the ith student in the second section. The class average is the average of the random variables $(Y_i + Z_i)/2$. Under our assumptions, these latter random variables can be modeled as i.i.d., and the CLT applies.

4. Unlike part (2), here the student scores are i.i.d., and the CLT applies.

Submit You have used 1 of 1 attempt

Answers are displayed within the problem

Discussion

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  I get the gist not after reading that "Consider the class average in an exam in a few different settings."...
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  This question has similarities to Pset Problem 6. Solving that helps to clarify this and vice versa.
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  I don't really follow what this distinction is supposed to be about. If the exam scores are dependent o...

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