



MITx: 6.041x Introduction to Probability - The Science of Uncertainty



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Exercise: CLT applicability

(1/4 points)

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


- ▶ Unit 6: Further topics on random variables
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Unit overview


Lec. 18: Inequalities, convergence, and the Weak Law of Large Numbers

Exercises 18 due Apr 27, 2016 at 23:59 UTC 


Lec. 19: The Central Limit Theorem (CLT)


Exercises 19 due Apr 27, 2016 at 23:59 UTC 

Lec. 20: An introduction to classical statistics

Exercises 20 due Apr 27, 2016 at 23:59 UTC 


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 

Solved problems**Additional theoretical material****Problem Set 8**

Problem Set 8 due Apr 27, 2016
at 23:59 UTC 

Unit summary

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 

Answer:

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 i th student from the first section and let Z_i be the score of the i th 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.

You have used 1 of 1 submissions

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