MATH 10B with Prof. Stankova | Student:
Section #208 ; time: 2-3:30pm | SID:
GSI: Ninh DO | **Quiz 12 Solution** | Tue 4/16/19

True/False - No explanation needed. (1pt for correct, 0pt - no answer, -1pt - incorrect)

1. The MLE always maximizes the probability the data occur. True/False
   True. This is the purpose of MLE.

2. Formulating the data likelihood, taking its logarithm (log) and setting the derivative of the log likelihood to 0 is always a good method to find the MLE. True/False
   False. Sometimes we don't have to take log nor even taking the derivative but still being able to find MLE.

Problems - Need justification. No justification means **zero**!

1. (10pts) Over all years, the MATH 10B midterm mean is 50 and the std is 10. This year, the instructor takes a sample of 36 students whose midterm mean is 60. He believes that students of this year are smarter than the average over years. Take the significance level $\alpha = 0.05$.
   (a) Perform the hypothesis test and draw a conclustion, i.e. formulate hypotheses, state one-sided/two-sided test, calculate p-value, draw conclusion.
   Hint: use $\bar{\sigma} = \dfrac{\sigma}{\sqrt{n}}$
   $H_0 : \mu = \mu_0 = 50$ vs $H_1 : \mu > \mu_0 = 50$, one-sided test
   z-score $= \dfrac{60 - 50}{10/\sqrt{36}} = 6$
   p-val $\approx 0.5 - 0.5 = 0 < \alpha = 0.05$, so rejecting the null H_0. Conclusion: there is strong evidence supporting that this year students are smarter than the previous year ones.

   (b) Calculate critical value and find the rejection region.
   Critical value: $50 + 1.96 * 10/\sqrt{36} \approx 53.3$, rejection region is $[53.3, \infty)$