General notes

Midterm will contain 6 problems. All the problems have equal weights. Midterm duration is 120 minutes. Closed book, one A4 cheatsheet is allowed.

Demo variant «Dolly»

1. Let X be a random variable that follows a uniform distribution on the interval $[10, 20]$ and $g(X) = \frac{1}{X}$.

   (a) Find $\mathbb{E}(g(X))$ and $\mathbb{V}\text{ar}(g(X))$ exactly by computing the expectation and variance directly from the definition of expectation.

   (b) Use the delta method to approximate $\mathbb{E}(g(X))$ and $\mathbb{V}\text{ar}(g(X))$.

   (c) Compare the exact variance obtained in part (a) with the approximation from part (b). Discuss the accuracy of the delta method in this case.

2. Consider a logistic regression model for the probability of success in the Econometrics course:

$$\mathbb{P}(y = 1 \mid h) = \frac{\exp(\beta_0 + \beta_1 h)}{1 + \exp(\beta_0 + \beta_1 h)},$$

   where y is a binary outcome variable, and h is a number of drawn hedgehogs.

   Suppose that the model has been estimated using a dataset of $n = 1000$ students, and the estimated coefficients along with their standard errors are: $\hat{\beta}_0 = -2.5$ with $se(\hat{\beta}_0) = 0.5$ and $\hat{\beta}_1 = 1.2$ with $se(\hat{\beta}_1) = 0.3$.

   (a) Compute the predicted probability $\hat{p}$ for $h = 2$.

   (b) Use the delta method to approximate the variance of $\hat{p}$ for $h = 2$.

   (c) Construct an approximate 95% confidence interval for p using a normal approximation and delta method.

   (d) Discuss the limitations of using the delta method in this context.

3.

4.

5.

6. Something on logit model from LSE external exam.

Demo variant «Sailor Moon»

1.

2.

3.

4.

5.

6. Something on logit model from LSE external exam.