BUEC 333-D200 Midterm
Version A **w/answers**

October 15, 2012, 14:30-16:20

Rules

1. For **all** of the questions below: Each question has zero, one, or multiple correct answers. If none of the statements are correct, write "None of the statements are true." If only answer (b) is correct, write "(b)". If (a), (b) and (d) are correct, write "(a), (b) and (d)". If you name all the correct statements, you earn 1 point. If you do not name all the correct statements, or you name an incorrect one, you earn 0 points.
2. Very important: on the front of your answer sheet, write "Version A".
3. **Correct answers have "correct" printed next to them.**

Questions

Consider the joint probability distribution represented in Table 1.

1. Which of the following statements is/are true?

   (a) $P(X_2 = 1|X_1 = 2) = 0.4$ **correct**
   (b) $P(X_2 = 3|X_1 = 2) = 0.1$
   (c) $P(X_2 = 1|X_1 = 3) = 1$ **correct**

2. Which of the following statements is/are true?

   (a) X_1 and X_2 are uncorrelated

		X_1		
		1	2	3
X_2	1	0.1	0.2	0.25
	2	0.1	0.2	0
	3	0.05	0.1	0

Table 1: Joint probability distribution.

(b) X_1 and X_2 are independent

3. Which of the following statements is/are true?

   (a) $P(X_1 \leq 2) = 0.75$ **correct**
   (b) $E(X_1) > 1$ **correct**
   (c) $P(X_2 = 2) = 0.1$

4. For the questions that follow: A random variable X has mean μ and variance σ^2. You have a random sample $(X_1, X_2, \cdots, X_N)$ of observations of X. The sample average is $\bar{X} = \frac{1}{N}\sum_{i=1}^{N} X_i$, and the sample variance is $s^2 = \frac{\sum_{i=1}^{N}(X_i - \bar{X})^2}{N-1}$. Which of the following statements about $\bar{X}$ and μ is/are true?

   (a) $\bar{X} = \mu$.
   (b) $Var(\bar{X}) = Var(\mu)$.
   (c) $E(\bar{X}) = E(X) = \mu$. **correct**

5. Which of the following statements is/are true?

   (a) $Var(\bar{X}) = \sigma^2$.
   (b) $Var(\bar{X}) = \sigma^2/N$. **correct**
   (c) $\sigma^2 = s^2$.

6. Consider the quantity $\frac{\bar{X}-\mu}{s/\sqrt{N}}$. Which of the following statements is/are true?

   (a) This quantity is called a $Z-$statistic.
   (b) It has a normal distribution with $N-1$ degrees of freedom.
   (c) It is a random variable. **correct**

7. Which of the following statement(s) is/are true?

   (a) $Var(\mu) = \sigma^2$
   (b) In regression models, $\hat{\beta}_0$ is a population parameter
   (c) The error term is the vertical distance from an observation to the sample regression line

8. This question is about the coefficient of determination, R^2. Which of the following statements is/are true?

   (a) $R^2 = \frac{\text{explained sum of squares}}{\text{total sum of squares}}$ **correct**
   (b) $R^2 = 1 - \frac{\text{residual sum of squares}}{\text{total sum of squares}}$ **correct**
   (c) The R^2 never decreases when you increase the number of explanatory variables. **correct**

i	X_i	Y_i
1	0	0
2	5	10

Table 2: Hypothetical sample for question 11.

9. Let $\hat{\beta}$ be the OLS estimator of a population regression coefficient β. You know that, given the assumptions that make up the "Classical model", the OLS estimator is *BLUE*. The "B" in BLUE stands for "best". What do we mean by "best"?

   (a) The OLS estimator $\hat{\beta}$ is equal to the population regression coefficient β.
   (b) The expected value of the $\hat{\beta}$ is equal to β.
   (c) The variance of the population regression coefficient, β, is as low as can be.
   (d) Among all linear, unbiased estimators for β, the OLS estimator $\hat{\beta}$ has the lowest variance. **correct**

10. Which of the following assumptions do you need in order for the OLS estimator to be BLUE?

    (a) No explanatory variable is a perfect linear function of any other explanatory variable(s) **correct**
    (b) The error term has a constant variance **correct**
    (c) The error term is normally distributed
    (d) All explanatory variables are uncorrelated with the error term **correct**

11. You are considering the regression model: $Y = \beta_0 + \beta_1 X_1 + \epsilon$, and have gathered data on X and Y, see Table 2. You will use OLS to estimate β_0 and β_1. It is given that $\hat{\beta}_1 = 2$. Which of the following statements is true:

    (a) $\hat{\beta}_0 = 0$ **correct**
    (b) $SSR = 0$ **correct** (also OK if you did not mention this one, given that I should have written RSS instead of SSR)
    (c) $R^2 = 1$ **correct**

12. The last two questions are about R. You want help on a command called "summary". What do you type at the R terminal?

    (a) ?summary **correct**
    (b) ??summary
    (c) help(summary) **correct**
    (d) summary?

13. Which command in R helps you do OLS estimation?

    (a) reg
    (b) regress
    (c) lm **correct**