

MSBA7003 Quantitative Analysis Methods

Assignment 4 (Due October 11 at 23:55; Please submit with the template)

Q1.

Solve the following (super hard) Sudoku problem through mixed integer programming.

A			8				7	
	9			B			3	
1					4	9		8
							9	
4				5				
	1		3			6		2
		C						7
	6		2			8		1
		2			3			D

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

A) **A** = 2.

B) **B** = 1.

C) **C** = 5.

D) **D** = 4.

E) None of the above.

Q2.

You are a factory manager and originally the workers are paid a fixed salary according to their skill levels. You want to introduce a productivity-based salary in a hope to increase worker productivity. To begin with, you randomly selected some male and female workers, respectively, according to the numbers given in following Table 1. The selected the workers adopted the new salary scheme in the next month. Their average productivities in the next month are shown in the following Table 2.

Table 1: Worker selection

Gender	Selected	Not Selected	Total Number
Male	15	35	50
Female	65	85	150

Table 2: Average productivity

Male	7 (selected)	6.0 (not selected)
Female	9 (selected)	7.5 (not selected)

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

- A) If you implement the new salary scheme for the whole factory, you can expect to increase workers' monthly productivity by 1.25 on average.
- B) The naïve estimator of $(7 \cdot 15/80 + 9 \cdot 65/80 - 6 \cdot 35/120 - 7.5 \cdot 85/120)$ is not biased.
- C) Let $D = 1$ for selected workers and 0 otherwise. Let $G = 1$ for male workers and 0 otherwise. Suppose we run the regression model: $Y = a + b \cdot D + c \cdot G + d \cdot D \cdot G + e$, where (a, b, c, d) are parameters and e is the error term. The estimated b should be about 1.5.
- D) Among those not selected, their average productivity is expected to be increased by 1.75 if they also adopt the new policy.
- E) None of the above.

Q3.

Jenny Wilson Realty is a real estate firm in Alabama. Jenny, the manager, wants to develop a model to determine a suggested listing price based on the size, age, and the condition (either good or excellent) of the house. A sample of historical data includes selling price (Y), the square footage (X_1), the age (X_2), and the condition ($X_3 = 1$ for being excellent and 0 for being good). Jenny runs a regression of Y against X_1 , X_2 , and X_3 . The estimated model is

$$\hat{Y} = 1.5 + 3X_1 - 0.5X_2 + 0.8X_3.$$

Suppose Jenny would like to find out how much the selling price can be affected by renovating a house and changing the condition from "good" to "excellent". Which of the following statement(s) is(are) true?

- A) Renovating a house is expected to increase its selling price by 0.8.
- B) Given the same square footage and age but different conditions, two houses' selling prices are expected to differ by 0.8.
- C) Given the same square footage and age, the condition of a house is completely independent of any other factors that can affect the selling price.
- D) Other variables (such as the location of a house) should be included in the regression in order to estimate how X_3 influences Y .
- E) None of the above.