Tutorial letter 201/2/2017

Basic Statistics

STA1510

Semester 2

Department of Statistics

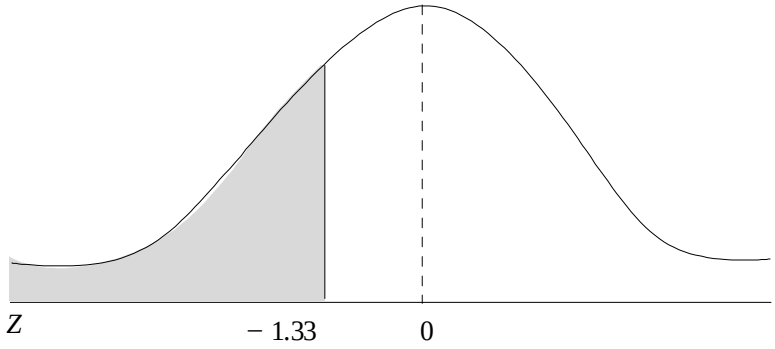
SOLUTIONS TO ASSIGNMENT 01

CHAPTER 6

QUESTION 1

Normal distribution
$\mu = 5$ and $\sigma = 0.75$
$P(X \leq 25)$ does not provide excellent service

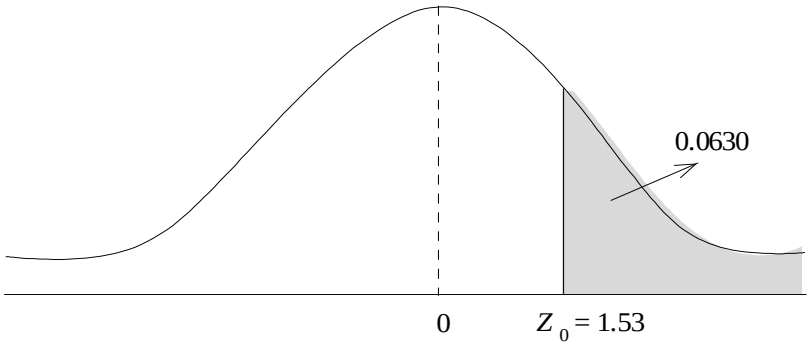
$$
\begin{aligned}
& P\,(Z \leq 4) \text{ at most four} \\
& P\left(Z \leq \frac{4-5}{0.75}\right) \\
& P\,(Z \leq -1.33) \\
= \quad & 0.0918
\end{aligned}
$$



Option 1

QUESTION 2

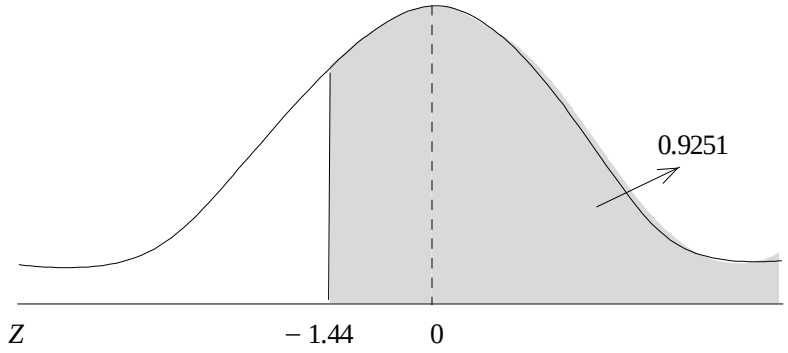
Standard Normal distribution (area to the right)



Option 3

QUESTION 3

Standard normal distribution
$P(Z > -1.44) = 0.9251$



All other options are incorrect.

Option 1

CHAPTER 5

QUESTION 4

Discrete random variable
Option 3 is the correct statement as follows

$$\begin{aligned} P\,(2 < X \leq 4) &= P\,(X \text{ is greater than } 2 \text{ but less or equal to } 4) \\ &= P\,(X = 3) + P\,(X = 4) \\ &= 0.299 + 0.138 \\ &= 0.4370 \end{aligned}$$

Option 3

QUESTION 5

Binomial (Properties or Characteristics)
Distribution is discrete
Option 4

QUESTION 6

Binomial
$\pi = 0.45$ and $n = 9$
Option 3 is incorrect, the corrected statement should be

$$\begin{aligned} P(X &= 0) = 9C_0 \left(0.45^0\right) (0.55)^{0-9} \\ &= 1 \times 1 \times 0.0046 \\ &= 0.0046 \quad \text{or} \quad 0.46\% \end{aligned}$$

the easier way will be to read the answer from the binomial probability table using the fact that $\pi = 0.45,\ n = 9$ and $X = 0$.

Option 3

QUESTION 7

Poisson
$\lambda = 3$ per night
Option 3 is correct.

$$P\,(X = 5) = \frac{3^5 \times e^{-3}}{5!} = 0.1008$$

or just use the poisson probability table, using the fact that:
$\lambda = 3$ with $X = 5$.

Option 3

CHAPTER 4

QUESTION 8

Probability (independent events)

$$\begin{aligned} P(SE) &= 0.2 \\ P\,(TH) &= 0.35 \\ P\,(SE \text{ and } TH) &= 0.2 \times 0.35 \\ &= 0.07 \quad \text{or} \quad 7\% \end{aligned}$$

There is a probability of 7% that a house in a secure estate and a townhouse will be broken into in the next year.

Option 1

QUESTION 9

Probability (addition rule)

$$\begin{aligned} P\,(F) &= 0.6 \\ P\,(C) &= 0.15 \\ P\,(F \cap C) &= 0.25 \\ \therefore \quad P\,(F \quad \text{or} \quad C) &= P\,(F) + P\,(C) - P\,(F \cap C) \\ &= 0.6 + 0.15 - 0.25 \\ &= 0.5 \quad \text{or} \quad 50\% \end{aligned}$$

There is a probability of 50% of randomly selecting a friend who prefers fruit juice or coffee.

Option 4

QUESTION 10

Probability
$P(A) = 0.30,\ P(B) = 0.20$ A & B mutually exclusive means $P(A \cap B) = 0$
Option 5 is the only incorrect statement because $P(A|B) \neq P(A)$ which is required for A and B to be independent.

$$P(A|B) = 0 \quad \text{and} \quad P(A) = 0.30$$

All other statements are correct.

Option 5

QUESTION 11

	A	B	Total
M	78	42	120
W	19	11	30
Total	97	53	150

$$P(W \cap B) = \frac{11}{150} = 0.0733 \quad \text{joint events}$$

Option 3

CHAPTER 3

QUESTION 12

Numerical descriptive measures

4	1 5 8
5	0 2 2 5 9
6	1 2 5 5 6 6 7
7	0 3

$$\begin{aligned} n &= 17 \\ \text{range} &= 73 - 41 = 32 \\ \text{mode} &= 52,\ 65,\ 66 \end{aligned}$$

The numbers appears twice.
Each option 2 becomes an incorrect statement.
We have trimodal case in this dataset.
Option 2

QUESTION 13

We have

0	0	0
1	1	1
2	2	
4	4	
5		

$$\begin{aligned} \text{Mode} &= 0 \text{ and } 1 \\ n &= 11 \\ \text{Median} &= 1 \\ \text{Mean} &= 1.82 \end{aligned}$$

Thus, mean is greater than the median, telling us that the distribution of this data set is positively skewed or skewed to the right.

Option 1

QUESTION 14

Measure of variation or dispersion

$$\begin{aligned} \text{Standard deviation} &= \frac{\sum \left(X_i - \bar{X}\right)^2}{n-1} \\ &= \frac{(0-1.82)^2 + \cdots + (5-1.82)^2}{11-1} \\ &= 1.78 \end{aligned}$$

Option 2

QUESTION 15

Quartiles
Start by ordering the values as follows:

$$-4,\ -3,\ -3,\ -1,\ 1,\ 2,\ 4,\ 5,\ 6,\ 10,\ 10$$

$n = 1$
First quartile (lower quartile) is found in position:

$$\begin{aligned} \frac{n+1}{4} &= \frac{11+1}{4} = 3^{\text{rd}} \text{ position} \\ \therefore &\quad \text{First quartile } (Q_1) = -3 \end{aligned}$$

Third quartile (upper quartile) is found in position:

$$\begin{aligned} \frac{3\,(n+1)}{4} &= \frac{3\,(12)}{4} = 9^{\text{th}} \text{ position.} \\ \therefore &\quad \text{Third quartile } (Q_3) = 6 \end{aligned}$$

$$\begin{aligned} \text{Interquartile (IQR) range} &= Q_3 - Q_1 \\ &= 6 - (-3) \\ &= 6 + 3 \\ &= 9 \end{aligned}$$

Option 2

CHAPTER 2

QUESTION 16

Summarizing categorical data
Table in terms of row percentages

	Female	Male	Total
Checkers	70	30	100%
PnP	58.85	41.18	100%
Spar	66.67	33.33	100%
Total	63.33	36.67	100%

70% (7 out of 10) of all checkers shoppers are female

Option 3

QUESTION 17

Summarizing numeric data
From the table only 4, i.e. $(3+1)$ out of 30 shoppers spend R1600 or more on groceries
This means that $\frac{4}{30} \times 100 = 13.33\%$

Option 1

QUESTION 18

Numeric data
From the table only 19, i.e. $(14+5)$ out of 30 shoppers spend between R800 and R1600 on groceries
This means that $\frac{19}{30} \times 100 = 63.33\%$

Option 1

CHAPTER 1

QUESTION 19

Types of data
Number of shoppers is a countable numeric value. It will be classified as quantitative, discrete data.
Option 1

QUESTION 20

Scales of measurement
Rating availability of parking space implies an ordinal variable and listing occupation is a nominal variable.
Option 2