Date:

(Assignment 3) Question 1

1) a) → Each of the face value of the dice has a probability between 0 and 1.
→ The total probability of all the faces of the dice is equal to
0.18 + 0.164 + 0.164 + 0.164 + 0.164 + 0.164 = 1
Therefore, this is a valid discrete probability distribution.

b) $P(X = 5) = 0.164$ $P(X = 6) = 0.164$

$P(X = 5 \text{ or } X = 6) = P(X = 5) + P(X = 6)$
$= 0.164 + 0.164$
$= 0.328$

c) $P(X = \text{even}) = P(X = 2) + P(X = 4) + P(X = 6)$
$= 0.164 + 0.164 + 0.164.$
$= 0.492$

d) $E(X) \text{ or } \mu_X = \sum_{\text{all } x} x_i p_i$

$= (1)(0.18) + (2)(0.164) + (3)(0.164) + (4)(0.164) + (5)(0.164) + (6)(0.164)$
$= 0.18 + 0.328 + 0.492 + 0.656 + 0.82 + 0.984$
$= 3.46$

Question 2

a) $Y = 1.5X$ → X is the number on the die
→ Y is the winnings.

b) $Y = 1.5X - 4$

Question 3

A)

Mean	Standard Deviation	Median	IQR
9.996	6.399	8.4	10

Table 1: Group A Summary Statistics

Mean	Standard Deviation	Median	IQR
12.304	7.581	9.2	14.7

Table 2: Group B Summary Statistics

B)

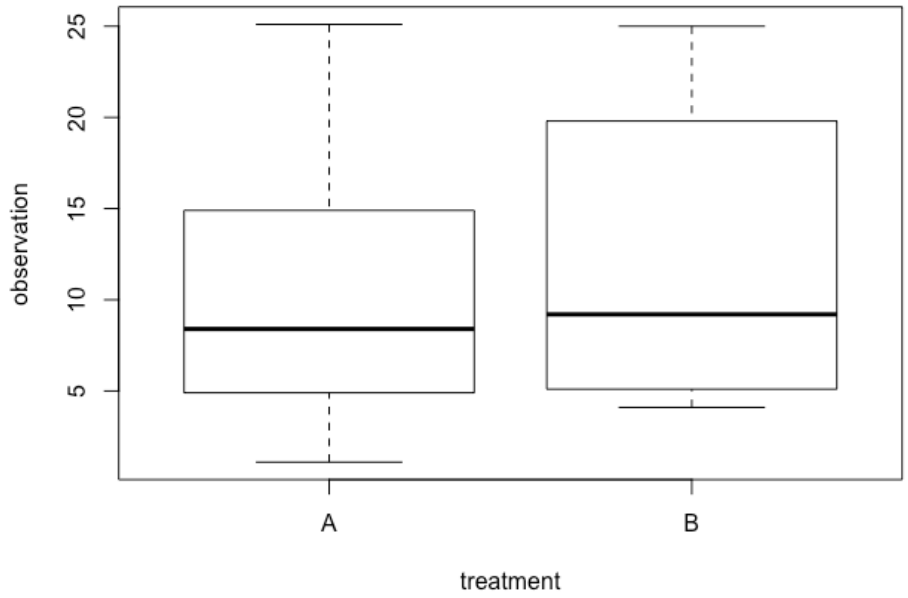

Figure 1: Side-by-side boxplot of the observation for the randomized treatment group A and group B for the treatment groups dataset. This plot shows that treatment group A has a smaller interquartile range as compared to the interquartile range of group. This also shows that treatment group A has a smaller spread in its observations than that of treatment group B.

C)

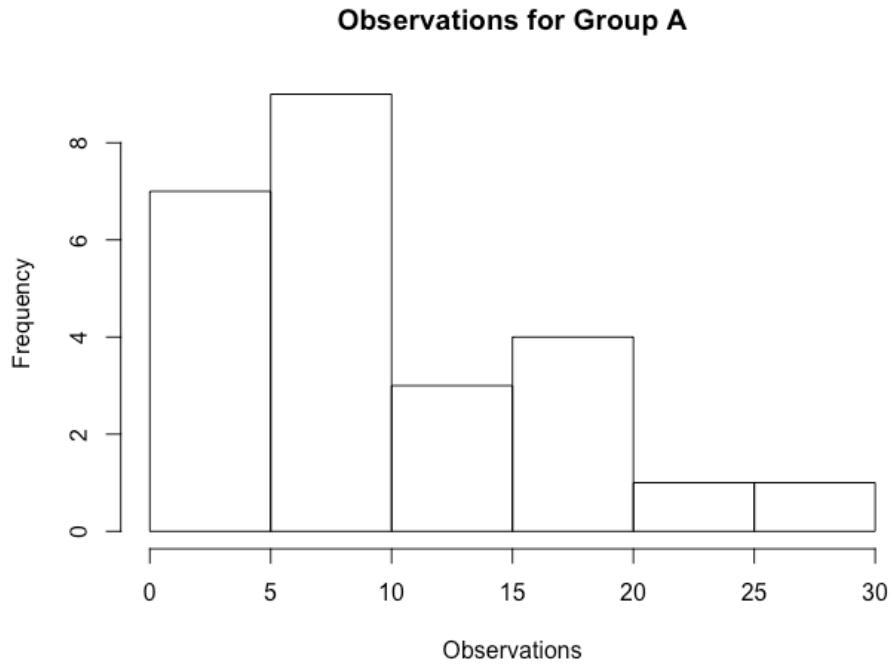

Figure 2: Histogram of the observation for the randomized treatment group A for the treatment group A dataset. This plot shows that the treatment group A has a right skewed and unimodal distribution.

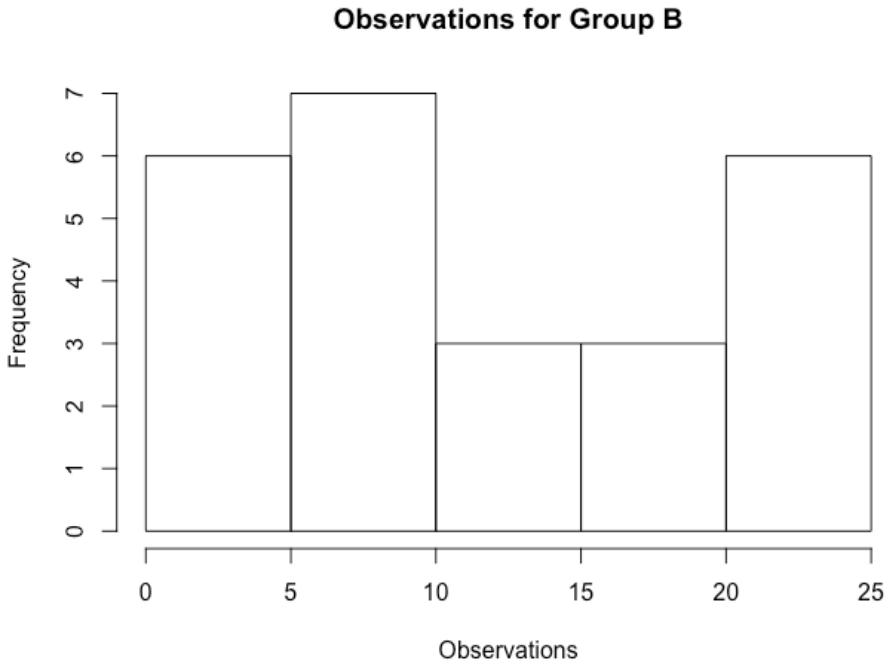

Figure 3: Histogram of the observation for the randomized treatment group B for the treatment group B dataset. This plot shows that the treatment group B has a bimodal distribution.

D) Shape : Treatment group A has a unimodal distribution whereas treatment group B has a bimodal distribution.

Location : Treatment group A has a lower mean and median than treatment group B.

Spread : Treatment group A has a lower interquartile range than treatment group B which also indicates that treatment group A has a less variable dataset than that of treatment group B.

Outliers : There are no outliers in both treatment group A and treatment group B distribution of observations.

E) In the case of the histograms, it is much harder to spot the differences of the two case studies as their histograms look more or less the same but the differences are more apparent in the boxplots. The spread of the predetermined high and low preservative groups boxplot in practical 2 shows that the low preservative group has a much larger spread than that of the high preservative group. In terms of the mean and median, the randomly allocated groups are more closely aligned that that of the predetermined high and low preservative groups in practical 2. The reason being is that the random allocation of observations in this case study produce two groups that are similar in all aspects which explains the similarities in both of the groups. However, the case study in practical 2 doesn't randomly allocate the groups instead they are predetermined which introduces selection bias into the study.

Question 4

A) The probability distribution of random variable X is of a binomial distribution.

- Binary: Each of the weighted coin only has a success and failure outcome such that success is the head and failure is the tail.
- Independence of trials: the results of any weighted coin tosses will not affect the results of the other weighted coin tosses.
- Fixed number of trials: the fixed number of trials is equal to 5 number of tosses.
- Success : the probability of success which is getting the head is equal to 0.75 for every single tosses.

B) I) **P(X = 0) ,**

dbinom(0, 5, 0.75) = 0.001

II) **P(X >= 1) = 1 – P(X = 0),**

1 – dbinom(0, 5, 0.75) = 1 – 0.001

= 0.999

III) **P(1 <= X <= 3) = P(X <= 3) - P(X = 0) ,**

pbinom(3, 5, 0.75) - dbinom(0, 5, 0.75) = 0.367 - 0.001

= 0.366

Question 5

A) **P(X < 60) = P(X <= 60) ,**

pnorm(60, 78, 6) = 0.001

B) **P(X > 90 or X < 60) = 1 - P(X<=90) + P(X<=60),**

(1 - pnorm(90, 78, 6)) + pnorm(60, 78, 6) = (1 – 0.977) - 0.001

= 0.023 - 0.001

= 0.022

C) **P(60 <= X <= 90) = P(X<=90) - P(X<=60),**

pnorm(90, 78, 6) - pnorm(60, 78, 6) = 0.977 - 0.001

= 0.996

D) **P(X < c) = 0.1,**

qnorm(0.1, 78, 6) = 70.311 kg