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HW2 for Statistics 1 Fall 2020

1) 1, 1, 3, 3, 4, 4, 5, 6, 6, 7, **7**, 9, 9, 10, 12, 12, 13, 15, 18, 23, 55

1a) 1st quartile = **4**

2^{nd} quartile = median = **7**

3^{rd} quartile = **12**

Interpretation: **75% of the length of stay is less than or equal to 12 days**.

1b) Interquartile range = 3^{rd} quartile – 1^{st} quartile

12-4 = **8**

Interpretation: **The median 50% of the length of stay is 8 days.**

1c) 0^{th} percentile = Min = 1

25^{th} percentile = Q_L = 4

50^{th} percentile = Q_M = 7

75^{th} percentile = Q_U = 12

100^{th} percentile = Max = 55

Interpretation: 75^{th} to 100^{th} percentile has the largest range between other percentiles.

1d) **55 is a potential outlier.**

1e) Median: 7

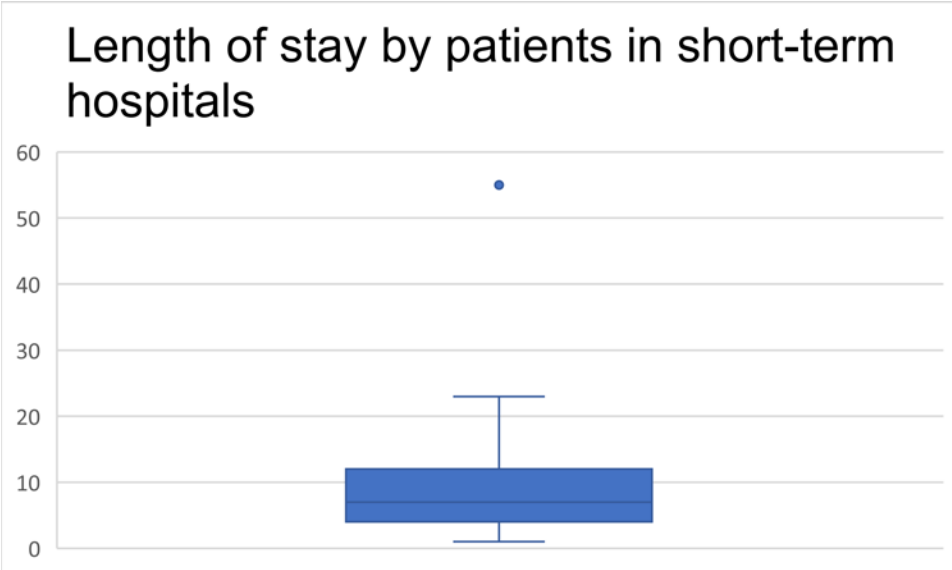
Inter-quartile range: 8

Upper Inner fence: $12 + 1.5(8) = 24$

Upper outer fence: $12 + 3(8) = 36$

Lower Inner fence: $4 - 1.5(8) = -8$

Lower outer fence: $4 - 3(8) = -20$



Interpretation: We can see 55 as the outlier. Data is right skewed which means most data lies on the lower end of the spread.

2a) Possible samples:

Governor (G) Lieutenant Governor (L) Secretary of State (S)
Governor (G) Lieutenant Governor (L) Attorney General (A)
Governor (G) Lieutenant Governor (L) Treasurer (T)
Governor (G) Secretary of State (S) Attorney General (A)
Governor (G) Secretary of State (S) Treasurer (T)
Governor (G) Attorney General (A) Treasurer (T)
Lieutenant Governor (L) Secretary of State (S) Attorney General (A)
Lieutenant Governor (L) Secretary of State (S) Treasurer (T)
Lieutenant Governor (L) Attorney General (A) Treasurer (T)
Secretary of State (S) Attorney General (A) Treasurer (T)

2b) Possibilities = 1

Probability = 1/10 = **0.1**

2c) Possibilities = 3

Probability = 3/10 = **0.3**

2d) Possibilities = 6

Probability = 6/10 = **0.6**

3) Two balanced dice rolls possibilities

(1,1) (2,1) (3,1) (4,1) (5,1) (6,1)
(1,2) (2,2) (3,2) (4,2) (5,2) (6,2)
(1,3) (2,3) (3,3) (4,3) (5,3) (6,3)
(1,4) (2,4) (3,4) (4,4) (5,4) (6,4)
(1,5) (2,5) (3,5) (4,5) (5,5) (6,5)
(1,6) (2,6) (3,6) (4,6) (5,6) (6,6)

Sum of dice possibilities are

(2) (3) (4) (5) (6) (7)
(3) (4) (5) (6) (7) (8)
(4) (5) (6) (7) (8) (9)
(5) (6) (7) (8) (9) (10)
(6) (7) (8) (9) (10) (11)
(7) (8) (9) (10) (11) (12)

The sum of dice does not have 11 possibilities but 11 distinct sums. The total possibilities are 36. The probability that the sum is 12 is $\mathbf{\frac{1}{36}}$.

4a) 10 men, 8 women, 12 jury size

At least 4 men chosen as 8 women and jury size 12

Sample space = {4, 5, 6, 7, 8, 9, 10}

4b) A = at least half of the 12 jurors are men

A = {6, 7, 8, 9, 10}

B = at least half of the 8 women are on jury

So, we can have 4, 5, 6, 7, or 8 women on the jury

B = {4, 5, 6, 7, 8}

$\boldsymbol{A \cup B = \{4, 5, 6, 7, 8, 9, 10\}}$

$\boldsymbol{A \cap B = \{6, 7, 8\}}$

$B^c = \{9, 10\}$

$\boldsymbol{A \cap B^c = \{9, 10\}}$

4c) Mutually exclusive $X \cap Y = \emptyset$

$\boldsymbol{A \cap B = \{6, 7, 8\} \neq \emptyset}$ **(not mutually exclusive)**

$\boldsymbol{A \cap B^c = \{9, 10\} \neq \emptyset}$ **(not mutually exclusive)**

$A^c = \{4, 5\}$

$\boldsymbol{A^c \cap B^c = \emptyset}$ **(mutually exclusive)**

5a)

(1,1) (2,1) (3,1) (4,1) (5,1) (6,1)
(1,2) (2,2) (3,2) (4,2) (5,2) (6,2)
(1,3) (2,3) (3,3) (4,3) (5,3) (6,3) (Thirty-six equally likely outcomes)
(1,4) (2,4) (3,4) (4,4) (5,4) (6,4)
(1,5) (2,5) (3,5) (4,5) (5,5) (6,5)
(1,6) (2,6) (3,6) (4,6) (5,6) (6,6)

A = event the sum of the dice is 7 = $\{(6,1), (5,2), (4,3), (3,4), (2,5), (1,6)\}$

$\boldsymbol{P(A) = \frac{6}{36} = \frac{1}{6} = 0.167}$

B = event the sum of the dice is 11 = $\{(6,5), (5,6)\}$

$\boldsymbol{P(B) = \frac{2}{36} = 0.056}$

C = event the sum of the dice is 2 = $\{(1,1)\}$

$\boldsymbol{P(C) = \frac{1}{36} = 0.028}$

D = event the sum of the dice is 3 = $\{(2,1), (1,2)\}$

$\boldsymbol{P(D) = \frac{2}{36} = 0.056}$

E = event the sum of the dice is 12 = $\{(6,6)\}$

$\boldsymbol{P(E) = \frac{1}{36} = 0.028}$

F = event the sum of the dice is 8 = $\{(6,2), (5,3), (4,4), (5,3), (2,6)\}$

$\boldsymbol{P(F) = \frac{5}{36} = 0.139}$

G = event doubles are rolled = $\{(1,1), (2,2), (3,3), (4,4), (5,5), (6,6)\}$

$\boldsymbol{P(G) = \frac{6}{36} = 0.167}$

5b) $\boldsymbol{P(A \cup B) = P(A) + P(B) = \frac{1}{6} + \frac{2}{36} = 0.223}$

5c) $\boldsymbol{P(C \cup D \cup E) = P(C) + P(D) + P(E) = \frac{1}{36} + \frac{2}{36} + \frac{1}{36} = 0.112}$

5d) $F \cup G = \{(6,2), (5,3), (4,4), (5,3), (2,6), (1,1), (2,2), (3,3), (5,5), (6,6)\}$

$\boldsymbol{P(F \cup G) = \frac{10}{36} = 0.278}$

5e) $\boldsymbol{P(F \cup G) = P(F) + P(G) + P(F \cap G) =} \frac{5}{36} + \frac{6}{36} - \frac{1}{36} \boldsymbol{= 0.278}$

6a) $\boldsymbol{P(F) = 51.5\% = 0.515}$

$\boldsymbol{P(D) = 10.4\% = 0.104}$

$\boldsymbol{P(F \cap D) = 6.0\% = 0.06}$

6b) $\boldsymbol{P(F \cup D) = P(F) + P(D) - P(F \cap D) = 0.515 + 0.104 - 0.06 = 0.559}$

55.9% U.S. adults are either female or divorced or divorced female

6c) $\boldsymbol{P(F') = P(Male) = 1 - 0.515 = 0.485}$

7a) $A = \{(HHH), (HTH), (HHT), (HTT)\}$

$\boldsymbol{P(A) = \frac{4}{8} = 0.5}$

$B = \{(HHT), (HTT), (THT), (TTT)\}$

$\boldsymbol{P(B) = \frac{4}{8} = 0.5}$

$C = \{(TTH), (HTT), (THT)\}$

$\boldsymbol{P(C) = \frac{3}{8} = 0.375}$

7b) $A \ \cap \ B = \{(HHT), (HTT)\}$

$P(A \ \cap \ B) = \frac{2}{8} = 0.25$

$\boldsymbol{P(B|A) = \frac{P(A \cap B)}{P(A)} = \frac{0.25}{0.5} = 0.5}$

7c) **A and B are independent as** $\boldsymbol{P(B|A) = P(B)}$

7d) $A \cap C = \{(HTT)\}$

$P(A \cap C) = \frac{1}{8} = 0.125$

$\boldsymbol{P(C|A) = \frac{P(A \cap C)}{P(A)} = \frac{0.125}{0.5} = 0.25}$

7e) **A and C are not independent as** $\boldsymbol{P(C|A) \neq P(C)}$

8a) $P(go\ to\ second\ edition) = P(more\ than\ projected\ and\ 2nd\ edition) + P(close\ to\ projected\ and\ 2nd\ edition) + P(less\ than\ projected\ and\ 2nd\ edition) = (0.1 * 0.7) + (0.3 * 0.5) + (0.6 * 0.2) = 0.34 = \mathbf{34}\%$

8b) $P(less\ than\ projected\ given\ go\ to\ second\ edition) = \frac{0.6*0.2}{0.34} = 0.353 = \mathbf{35.3}\%$

9a) $12\ choose\ 2 = \frac{12!}{2!(12-2)!} = \mathbf{66}$

9b) $12\ permute\ 3 = \frac{12!}{(12-3)!} = \mathbf{1320}$

9c) Quinella: $8\ choose\ 2 = \frac{8!}{2!(8-2)!} = \mathbf{28}$

Trifecta: $8\ permute\ 3 = \frac{8!}{(8-3)!} = \mathbf{336}$

10a) $100\ choose\ 5 = \frac{100!}{5!(100-5)!} = \mathbf{75,287,520}$

10b) $50\ choose\ 5 * 2^5 = \frac{50!}{5!(50-5)!} * 2^5 = \mathbf{67,800,320}$

10c) $P(no\ state\ will\ have\ both\ senator\ if\ random) = \frac{possibilites\ wih\ 1\ senetor\ from\ each\ state}{total\ possibilites} = \frac{67800320}{75287520} = \mathbf{0.901}$