

25 pts.

ISE 2211 • Exam I • 6 September 2019

NAME

SOLUTION

1) A new study linking ice cream consumption with overall workplace productivity has been published, based on a sample of 136 subjects with data collected between 1961 and 1974. Is this a retrospective study, observational study, or designed experiment? Can it state that there is a cause-and-effect relationship between ice cream consumption and workplace productivity?

No

(+1)

(only a designed experiment)

2) The following is a sample of water temperature measurements in degrees Fahrenheit from the return line of a hydronic heating system. Compute the sample mean, sample variance, sample standard deviation, and sample range. Include a unit with each answer.

Hint:  $s^2 = \frac{\sum x_i^2 - \frac{(\sum x_i)^2}{n}}{n-1}$

110.5  
181.0  
~~173.4~~  
~~164.8~~  
152.7  
109.3 ← min  
~~112.4~~  
~~156.3~~  
~~173.5~~  
188.3 ← max  
~~146.6~~  
~~157.3~~  
~~160.0~~  
~~139.4~~

$$\bar{x} = \frac{\sum x}{n} = 151.8 \text{ } ^\circ\text{F}$$

(+1) (+1)

$$s^2 = \frac{331351.4 - \frac{2125.5^2}{14}}{14-1} = 665.8 \text{ } ^\circ\text{F}^2$$

(+2) (+1)

$$s = \sqrt{665.8} = 25.80 \text{ } ^\circ\text{F}$$

(+1) (+1)

$$r = 188.3 - 109.3 = 79 \text{ } ^\circ\text{F}$$

(+1) (+1)

279

3) Compute the number of ordered configurations of my three deranged children performing seven dangerous activities in the house (e.g., jumping on the couch, teasing un-declawed cats, etc.).

Formulae:

Ordered = permutations

$$P(r) = \frac{n!}{(n-r)!}$$

$$\binom{n}{r} = \frac{n!}{r!(n-r)!}$$

$$P\left(\begin{matrix} 7 \\ 3 \end{matrix}\right)$$

correct  
eqn.

$$+1$$

$$= \frac{7!}{(7-3)!} = \frac{7 \cdot 6 \cdot 5 \cdot \cancel{4!}}{\cancel{4!}}$$

$$= 210$$

$$+1$$

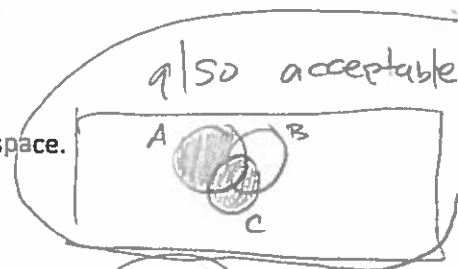
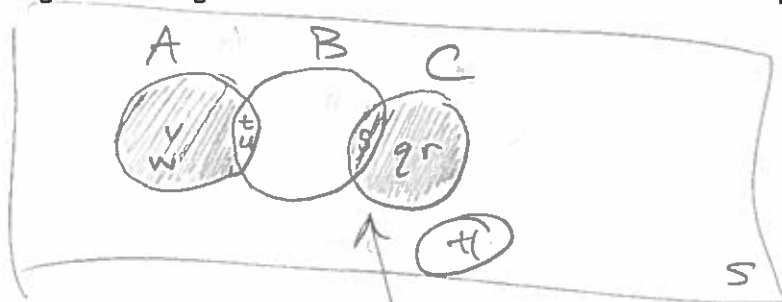
1/2 pts

4) A sample space contains the outcomes  $S\{q r s t u v w\}$  with associated probabilities shown below. Define event  $E_A\{t u v w\}$ ,  $E_B\{s t u\}$ , and  $E_C\{q r s\}$ . Is this an exhaustive set?

yes, all outcomes are contained in events

- $P(q) = 0.434$
- $P(r) = 0.235$
- $P(s) = 0.101$
- $P(t) = 0.139$
- $P(u) = 0.004$
- $P(v) = 0.027$
- $P(w) = 0.060$

Sketch a Venn diagram showing these three events and all outcomes in the sample space.



+2

all outcomes in respective events w/ intersection

Perform the following set operations and resulting probability for each.

$E_A \cup E_C'$

$$E_C' = \{t u v w\} = E_A \quad (+1)$$

$$E_A \cup E_A = E_A$$

$$\therefore P(E_A) = 0.139 + 0.004 + 0.027 + 0.060 = 0.23 \quad (+1)$$

$E_B \cap E_C$

$$\{s t u\} \cap \{q r s\} = \{s\} \quad (+1)$$

$$P(s) = 0.101 \quad (+1)$$

$(E_A \cap E_B') \cup E_C$

Additionally, shade this operation on the Venn diagram.

$$E_B' = \{q r v w\} \quad (+1)$$

$$E_A \cap E_B' = \{t u v w\} \cap \{q r v w\} = \{v w\} \quad (+1)$$

$$P((E_A \cap E_B') \cup E_C) = \{v w\} \cup \{q r s\} = \{v w q r s\} \quad (+1)$$

$$P = 0.027 + 0.060 + 0.434 + 0.235 + 0.101 = 0.857 \quad (+1)$$