

1) What is the crucial difference between an observational study and a designed experiment? Which of these can suggest cause and effect? +1

designed experiment: deliberate changes made to controllable variables and outcomes recorded and analyzed with respect to these changes +1

2) Here are some stats exam scores in points.

S{ 99 62 83 91 45 77 90 92 }

Compute the sample variance and sample standard deviation. Include units with your answers.

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

$$s^2 = \frac{53333 - \frac{639^2}{8}}{7} = 327.6 \text{ points}^2$$

+2 +1

$$s = \sqrt{s^2} = 18.10 \text{ points}$$

+1 +1

Now calculate the population mean and variance. (Hint: this is a trick question.)

you can't

+1

3) What is a random experiment?

Same experiment replicated many times
yields different results

(+1)

4) Joe Tritschler has three children under age two. He used to be smart, and some people actually thought he was almost cool, but now he is permanently damaged. Anyway, two out of three of them are boys. Determine the number of ordered combinations of three children in which two are boys. Likewise, determine the number of unordered combinations. Extra credit (one point): list all ordered and unordered combinations of two boys and one girl.

Formulae:

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

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

ordered combinations (permutations):

$$P_2^3 = \frac{3!}{(3-2)!} = 6$$

(+1) eqn.

(+1) answer

Unordered combinations:

$$\binom{3}{2} = \frac{3!}{2!(3-2)!} = \frac{3 \times \cancel{2!}}{\cancel{2!}} = 3$$

(+1) eqn

(+1) answer

extra credit:

(+1)

ordered

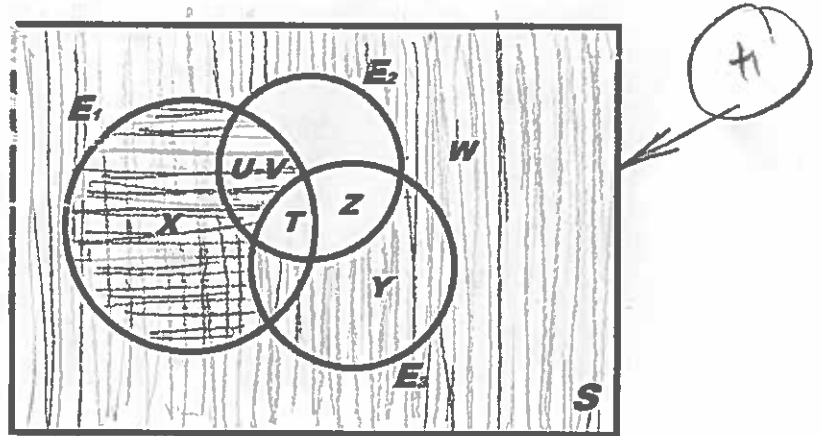
b₁ b₂ g
b₂ b₁ g
b₁ g b₂
b₂ g b₁
g b₁ b₂
g b₂ b₁

Unordered

b b g
b g b
g b b

5) Here is a Venn diagram describing a set of outcomes in a sample space with three events. Probabilities associated with each outcome are as follows:

$$\begin{aligned} P(T) &= 0.34 \\ P(U) &= 0.21 \\ P(V) &= 0.02 \\ P(W) &= 0.06 \\ P(X) &= 0.13 \\ P(Y) &= 0.17 \\ P(Z) &= 0.07 \end{aligned}$$



Write the outcomes associated with each event and determine their probabilities.

$$E_1 \{T U V X\}$$

$$E_2 \{T U V Z\}$$

$$E_3 \{T Y Z\}$$

$$P(E_1) = 0.34 + 0.21 + 0.02 + 0.13 = 0.7$$

$$P(E_2) = 0.34 + 0.21 + 0.02 + 0.07 = 0.64$$

$$P(E_3) = 0.34 + 0.17 + 0.07 = 0.58$$

Perform the following set operations, showing the resulting outcomes and total probability.

$$E_1 \cup E_2$$

$$P \{T U V X Z\}$$

$$= 0.77$$

$$E_2 \cap E_3' = \{T U V Z\} \cap \{W X U V\}$$

$$P \{U V\} = 0.21 + 0.02 = 0.23$$

$$(E_1 \cap E_3') \cup E_2'$$

Additionally, shade this operation on the Venn diagram.

$$= (\{T U V X\} \cap \{U V W X\}) \cup \{W X Y\}$$

$$\begin{aligned} P(\{U V X\} \cup \{W X Y\}) &= P \{U V W X Y\} \\ &= 0.59 \end{aligned}$$