Class 3

We ask opinion on a project
- 3 students
- response 1-10

1st 10 possibilities
2nd 10
3rd 10
$10 \times 10 \times 10 = 1000$

$S = \{(x_1, x_2, x_3) : x_1, x_2, x_3 = \{1, 2, 3, 4, \ldots, 10\}\}$ ← such that

Sets $\{(1,1,1), (2,2,2), (3,3,3)\}$
assigning numbers to sets

$A = \{(x_1, x_2, x_3) : x_1 = x_2 = x_3 \text{ and } x_1, x_2, x_3 \leq 3\}$
$x_1 \leq 3$

$B = \{(x_1, x_2, x_3) : x_1 = x_2 = x_3\}$

$A \subseteq B$

Sets: collection of outcomes

$\{(1,1,1)\}$ simple event
A, B, S are compound events because they contain more than 1 outcome

Example: Producing resistors
1000 Ω target resistance
950 Ω to 1050 Ω acceptable.
Sample 4 resistors, measure whether resistance falls in an acceptable range.

0: acceptable 1: unacceptable
16 possible outcomes 2^4

$S = \{(x_1, x_2, x_3, x_4) : x_1, x_2, x_3, x_4 = \{0, 1\}\}$

Let E_i be the event that the ith resistor tests acceptable.
↳ this means $x_i = 0$

$E_1 = \{(0, x_2, x_3, x_4) : x_2, x_3, x_4 = \{0,1\}\}$

$E_2 = \{(x_1, 0, x_3, x_4) : x_1, x_3, x_4 = \{0,1\}\}$

E_3, E_4 are similar

Mutually Exclusive

A and B, if no element of A is in B then A and B is mutually exclusive

$A \cap B = \emptyset$ ← intersection

$\{\}$

A and B are mutually exclusive if $A \cap B = \emptyset$

$A \cap B$: set of events both in A and B

E_1, E_2, E_3, E_4, are they mutually exclusive?

if you have more than two sets, $A_1, A_2, \ldots, A_n$ we say they are mutually exclusive if...

$$A_i \cap A_j = \emptyset \quad \forall i \neq j \in \{1, \ldots, n\}$$

$E_1 \cap E_2$: Set of ~~events~~ outcomes such that $x_1 = 0$ and $x_2 = 0$

Set of ~~events~~ outcomes such that $x_1 = 0$

Set of ~~events~~ outcomes such that $x_2 = 0$

$\{(0, 0, x_3, x_4) : x_3, x_4 = \{0,1\}\}$

$\neq \emptyset$

So E_1, E_2, E_3, E_4 not mutually exclusive

B_1: event that all resistors test acceptable

$B_1 = \{(0,0,0,0)\}$

$|B_1| = 1$

B_2: exactly 1 resistor tests unacceptable

$B_2 = \{(1,0,0,0), (0,1,0,0), (0,0,1,0), (0,0,0,1)\}$

$B_2 = \{(x_1, x_2, x_3, x_4): x_1+x_2+x_3+x_4=1,\ x_1, x_2, x_3, x_4 \in \{0,1\}\}$

$B_1 \cup B_2$

↑ union

union of A and B is the set of events either in A or B or both

$B_1 \cup B_2 = \{(0,0,0,0), (1,0,0,0), (0,1,0,0), (0,0,1,0), (0,0,0,1)\}$

$B_1 \cup B_2 = \{(x_1, x_2, x_3, x_4): x_1+x_2+x_3+x_4 \leq 1,\ x_1, x_2, x_3, x_4 \in \{0,1\}\}$

outcome such that there is 1 or less unacceptable behavior.

$B_1 \cap B_2 = \emptyset$

↑ null set {}

express B_1 in terms of E_1, E_2, E_3, E_4

↑ ↑ ↑ ↑

$x_1=0$ $x_2=0$ $x_3=0$ $x_4=0$

$E_1 \cap E_2 = \{(0,0,x_3,x_4): x_3, x_4 \in \{0,1\}\}$

$(E_1 \cap E_2) \cap E_3 = \{(0,0,0,x_4): x_4 \in \{0,1\}\}$

$B_1 = E_1 \cap E_2 \cap E_3 \cap E_4$