

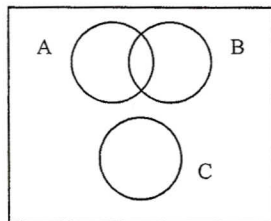
Probability – Group Examples
CIVL 3103

1. Disks of polycarbonate plastic from a supplier are analyzed for scratch and shock resistance. The results from 100 disks are summarized below.
 - a. If a disk is selected at random, what is the probability that its scratch resistance is high and shock resistance is high?
 - b. If a disk is selected at random, what is the probability that its scratch resistance is high or its shock resistance is high?
 - c. Consider the event that a disk has high scratch resistance and the event that a disk has high shock resistance. Are these two events mutually exclusive?

		Shock Resistance	
		High	Low
Scratch Resistance	High	70	9
	Low	16	5

2. The probability that a lab specimen contains high levels of contamination is 0.10. Five samples are checked, and the samples are independent.
 - a. What is the probability that none contains high levels of contamination?
 - b. What is the probability that exactly one contains high levels of contamination?
 - c. What is the probability that at least one contains high levels of contamination?
3. On graduation day at a large university, one graduate is selected at random. Let A represent the event that the student is an engineering major, and let B represent the event that the student took a calculus course in college. Which probability is greater, $P(A|B)$ or $P(B|A)$? Explain.
4. A developer of a new subdivision offers a prospective home buyer a choice of 4 designs, 3 different heating systems, a garage or carport, and a patio or screened porch. How many different plans are available to this buyer?
5. Three events are shown on the Venn diagram in the following figure. Reproduce the figure, and shade the region that corresponds to each of the following events.

- a. A'
- b. $(A \cap B) \cup C$
- c. $(A \cap B)' \cup C$
- d. $(A \cap B) \cup (A \cap B')$
- e. $(B \cup C)'$



1. a) $\uparrow SR$ and $\uparrow SHR$

$$70/100$$

b.) $\uparrow SR$ or $\uparrow SHR$

$$\text{Scratch high} : (70+9)/100$$

$$\text{Shock high} : (70+16)/100$$

$$\text{Scratch} \uparrow \cup \text{Shock} \uparrow = \frac{(70+9+70+16-70)}{100} = \frac{95}{100}$$

c.) No - you can have both high scratch and high shock resistance.

$$2. a) P(\text{none}) = \overset{\text{and}}{\uparrow} = (1-.1)(1-.1)(1-.1)(1-.1)(1-.1) = .9^5 = \underline{\underline{0.5905}}$$

$$b.) P(1) = (.1)(.9)(.9)(.9)(.9) + (.9)(.1)(.9)(.9)(.9) + \\ (.9)(.9)(.1)(.9)(.9) + (.9)(.9)(.9)(.1)(.9) + \\ (.9)(.9)(.9)(.9)(.1) = 5 \cdot (.1)(.9)^4 = \underline{\underline{0.328}}$$

$$c.) P(\text{at least 1}) = 1 - P(\text{none}) \\ = 1 - (.9)^5 = \underline{\underline{.4095}}$$

$$3.) P(A|B) = P(\text{engineering major} | \text{calculus}) \\ P(B|A) = P(\text{calculus} | \text{engineering major})$$

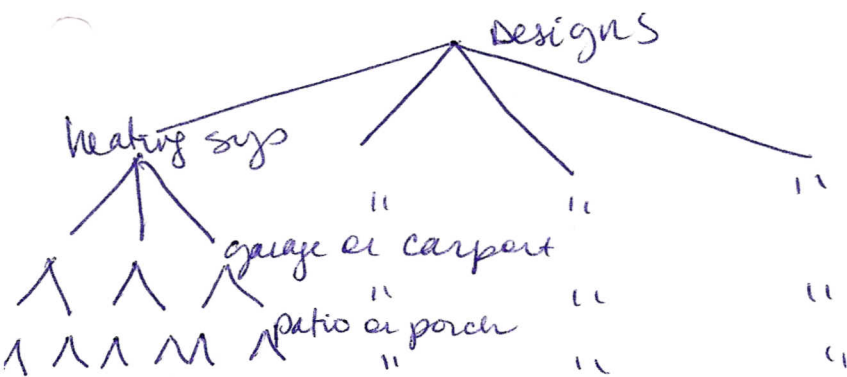
$$P(B|A) \approx 1$$

$$P(A|B) < 1$$

$$P(B|A) > P(A|B)$$

The probability that a student took calculus, given he is an engineering major is greater than the probability that a student is an engineering major, given he took calculus.

4. Use tree diagram:

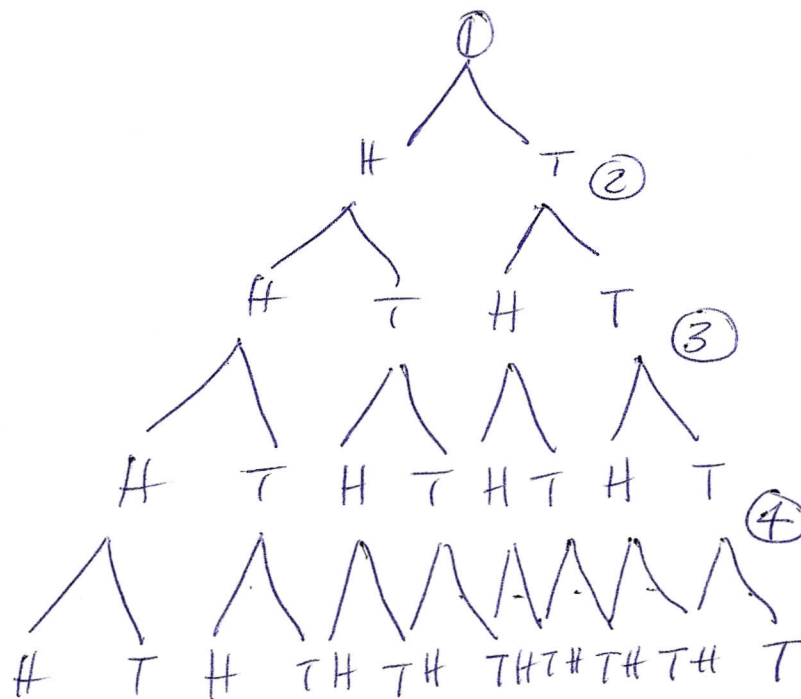


$12 \times 4 = 48$ different plans.

-OR- use

$$4 \cdot 3 \cdot 2 \cdot 2 = \underline{\underline{48}}$$

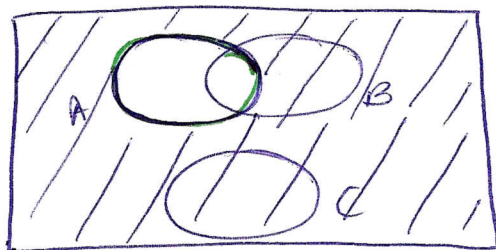
Ex: Toss coin 4 times:



①6

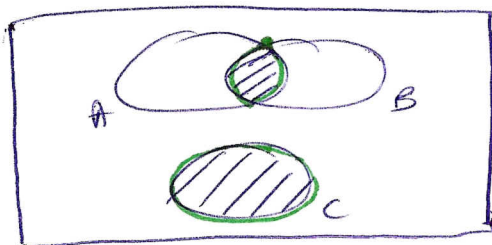
5.

a.)



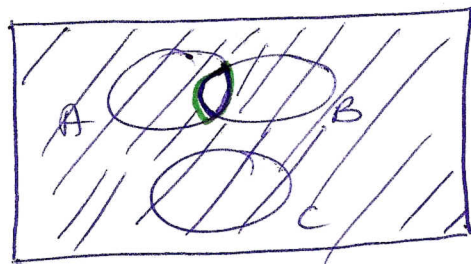
A'

b.)



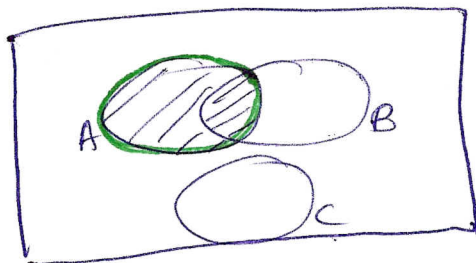
$(A \cap B) \cup C$

c.)



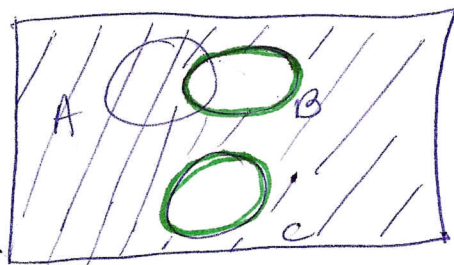
$(A \cap B)' \cup C$

d.)



$(A \cap B) \cup (A \cap B')$

e.)



$(B \cup C)'$