Note Title Math 160 Sp'10 Lowman, Week 11, Mon 4/6/2010

Probability Examples:

example: A survey of senior citizens at a doctor's office shows that 30% of the seniors take blood pressure lowering medication and 40% take cholesterol lowering medication. 40% do not take either medication. What is the probability that a senior citizen takes either blood

Blood pressure or cholesterol lowering medication?

Summarize the problem:

$P(B) = .3$, $P(C) = .4$

$P(\text{Neither}) = P(\bar{B} \text{ and } \bar{C}) = 40\% = .4$

$P(\text{takes either } B \text{ or } C) = P(B \cup C) = ?$

Try Addition Rule:

$$P(B \cup C) = P(B) + P(C) - P(B \wedge C)$$

$$= .3 + .4 - ???$$

Know $P(B \wedge \bar{C})$ and not $P(B \wedge C)$

This is an example of where it might be convenient to first organize the problem with a table.

Starting over with a table:

Given:

$P(B) = .3$, $P(C) = .4$, $P(\bar{B} \cap \bar{C}) = .4$

$P(B \cup C) = ?$

	C	$\bar{C}$	
B	$.1$	$.2$	$.3$
$\bar{B}$	$.3$	$.4$	$.7$
	$.4$	$.6$	1

$B =$

$C =$

$P(B \cup C) = .3 + .1 + .2 = \underline{\underline{.6}}$

Alternate: Use the same table info. but with the addition rule:

$$P(B \cup C) = P(B) + P(C) - P(B \cap C)$$
$$= .3 + .4 - .1 \text{ from table}$$
$$= \underline{\underline{.6}}$$

Alternate Method:

$P(B) = .3 \qquad P(C) = .4 \qquad P(\overline{B} \cap \overline{C}) = .4$

$$P(B \cup C) = 1 - P(\overline{B \cup C})$$ Complement Rule

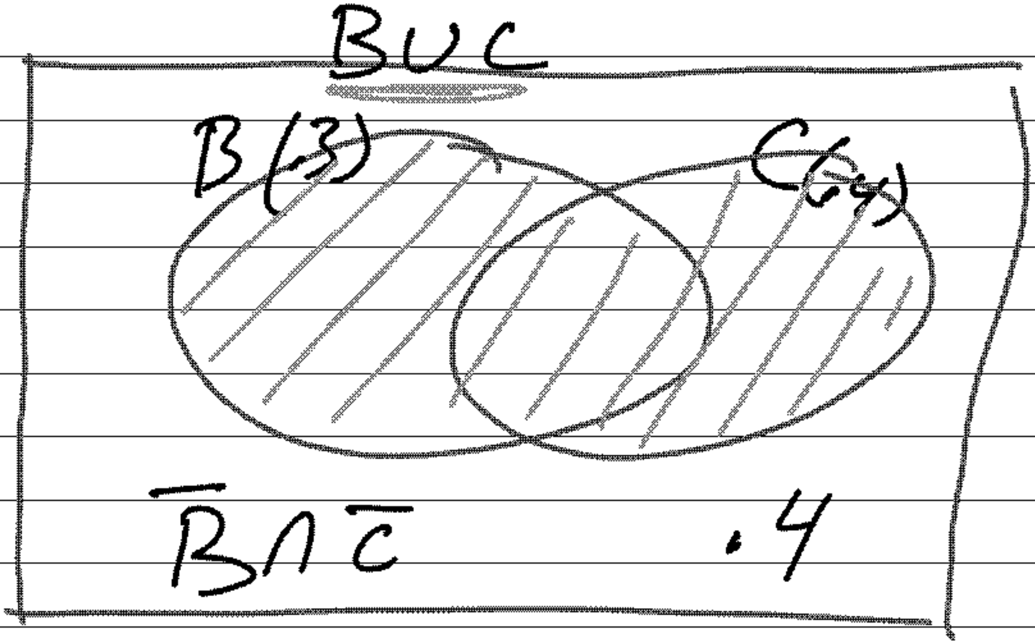
$$= 1 - P(\overline{B} \cap \overline{C})$$ DeMorgan's Law

$$= 1 - .4$$

$$= \underline{\underline{.6}}$$

Alternate Method: Venn Diagram

$P(B) = .3 \quad P(C) = .4 \quad P(\overline{B} \cap \overline{C}) = .4$



$P(B \cup C) = 1 - .4 = \underline{\underline{.6}}$

Example: A teacher has 15 students in her class. In how many ways can she form 3 groups with 5 students in each group? The class is going to see a movie.

This is an unordered partition problem.

If it was an Ordered Partition then

$$N = \frac{15!}{5!\,5!\,5!} = \frac{15!}{(5!)^3}$$ This is not correct!

Unordered Partition $\Rightarrow$ must divide by the number of ways to arrange the three equal groups.

$$\Rightarrow N = \frac{15!}{5!\,5!\,5!\,3!} = \frac{15!}{(5!)^3 \cdot 3!}$$ correct answer.

Example: Given table of probabilities

X	1	4	7	8	11
$P(X)$	.3	.1	?	.2	.1

$P(X \text{ is at least } 7) = ?$

$P(X \text{ at least } 7) = P(7 \text{ or } 8 \text{ or } 11)$

$= P(7) + P(8) + P(11) = \underline{P(7)} + .2 + .1$

need this.

To find the missing probability use that fact that $\sum_{\text{all } i} P(x_i) = 1$

from $P(S) = 1$.

$$P(1) + P(4) + P(7) + P(8) + P(11) = 1$$

$$.3 + .1 + P(7) + .2 + .1 = 1$$

$$\Rightarrow P(7) = 1 - .7 = .3$$

giving $P(7 \text{ or } 8 \text{ or } 11) = .3 + .2 + .1 = \underline{.6}$