Note Title

Math 160 Sp10 Lowman, Week 12 Wed

4/8/2010

- Probability Review (cont.)

#10 practice final

Given:

$P(A) = .5$, $P(\bar{B}) = .6$, $P(\bar{A} \cap \bar{B}) = .1$

(a) Determine if A and B are independent.

(b) Determine if A and B are mutually Exclusive.

Note: tables, trees, Venn Diagrams are often useful for organizing.

- Trees are often useful when conditional probabilities are given
- Tables are often useful when probabilities of intersections are given.
- Venn Diagrams are essentially the same as tables.

First fill in the table then finish the problem

O ⇒ Given Values

	B	$\bar{B}$	
A	0	.5	.5
$\bar{A}$	.4	.1	.5
	.4	.6	1

(a) Are A and B independent?

Test for independence:

If $P(A \cap B) = P(A) \cdot P(B)$

then A and B are independent.

Otherwise A and B are dependent.

Test: $P(A \cap B) = 0$

$P(A) \cdot P(B) = (.5)(.4) = .02$

$P(A \cap B) \neq P(A) \cdot P(B)$ so A and B are not independent. They are dependent.

(b) are A and B mutually exclusive?

A and B are mutually exclusive if either $A \cap B = \phi$

or $P(A \cap B) = 0$.

From the table $P(A \cap B) = 0$ so

A and B are mutually exclusive.

Important observation:

If A and B are independent

then so are $A, \bar{A}, B$ and $\bar{B}$.

So $P(A \cap B) = P(A) \cdot P(B)$ $\qquad P(A \cap \overline{B}) = P(A) \cdot P(\overline{B})$

$P(\overline{A} \cap B) = P(\overline{A}) \cdot P(B)$ $\qquad P(\overline{A} \cap \overline{B}) = P(\overline{A}) \cdot P(\overline{B})$

If one pair is independ then all pairs are independent.

The same is not true for mutually exclusive events.

In this example $P(A \cap B) = 0$ so A and B are mutually exclusive.

$P(A \cap \overline{B}) \neq 0$ so A and $\overline{B}$ are not mutually exclusive.

This makes sense because:

A, B mutually exclusive means

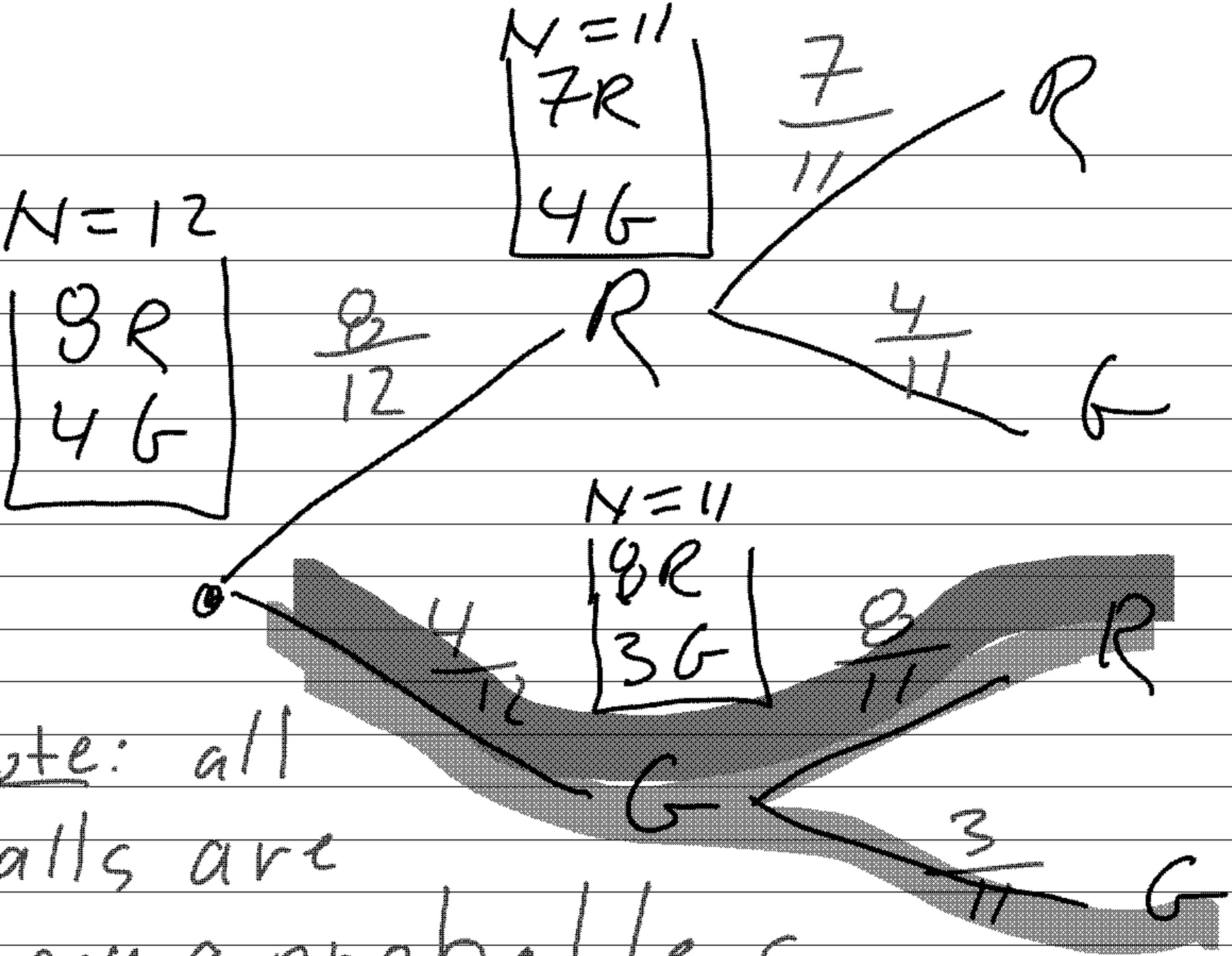
that if event A did occur then B cannot occur. If B cannot occur then $\bar{B}$ did occur. i.e. A and $\bar{B}$ are not mutually exclusive when A and B are mutually exclusive

#11 practice final

*A box has 8 Red balls and 4 Green balls. Two are picked at random w/o replacement. Find the probability that the second ball is red given that a green ball is picked.

There man ways to organize and work this problem. The probabilities of the 2nd ball picked are conditional so a tree will work. (There are simpler ways but a tree is easy and works).

Start by drawing pictures and tree.



Note: all balls are equaprobable so the Classical Method can be used.

$$P(R_{2nd} \mid G_{1st}) = \frac{P(R_{2nd} \cap G_{1st})}{P(G_{1st})}$$

get probabilities from tree.

$$= \frac{\frac{4}{12} \cdot \frac{8}{11}}{\frac{4}{12} \cdot \frac{8}{11} + \frac{4}{12} \cdot \frac{3}{11}} = \frac{\cancel{\frac{4}{12}} \cdot \frac{8}{11}}{\cancel{\frac{4}{12}}\underbrace{\left(\frac{8}{11} + \frac{3}{11}\right)}_{1}}$$

$$= \frac{8}{11}$$