Agenda for Wednesday, Oct 9th 2024

Coming up

- ! **HW 10** due today, Oct 9th   HW 11 on Monday
- Group Quiz 4 is a take-home activity on Probability
- ! **Exam 2** on Wednesday Oct 16th - Study guide and practice will be posted by end of Friday
  Friday: 12-1:15pm
- Student Hours today 3:45pm-5pm and ~~Thursday 1-2:15pm~~ in C162
- Carrera de los Lancers 5k on Saturday - Meet at 10 am in front of gym

Recall:

Using Tree Diagrams

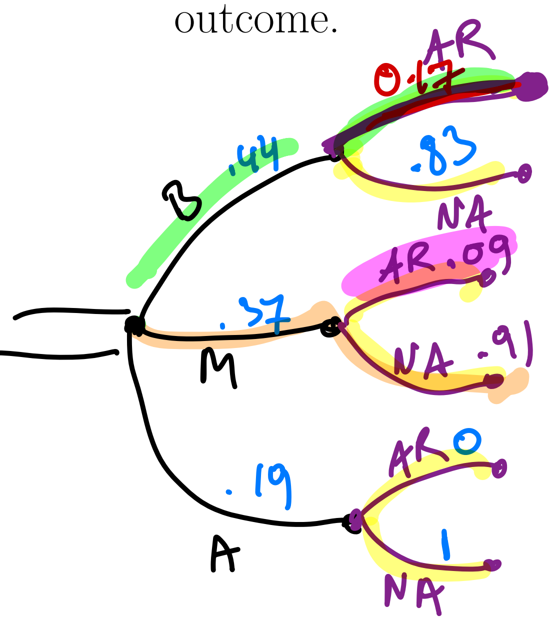
$P(B) = .44$, $P(M) = .37$
$P(A) = .19$

The kind of picture that helps us look at conditional probabilities and multiplication rule for dependent events is called a **tree diagram**.

Example 1. According to a study 44% of college students engage in binge (B) drinking, 37% drink moderately (M), and 19% abstain entirely. Another study finds that among binge drinkers, 17% have been involved in an alcohol-related automobile accident, while among non-bingers of the same age, only 9% have been involved in such accidents.

AR – alch. related accident
NA – no alch rel. accident

1. Build a tree diagram with corresponding probabilities on each possible outcome.



Small branches are conditional.

$P(AR \mid B) = 0.17$

$$P(* \mid ☆) = \frac{P(* \text{ and } ☆)}{P(☆)}$$

$$P(* \text{ and } ☆) = P(☆) \cdot P(* \mid ☆)$$

2. What's the probability that a randomly selected college student will be a binge drinker **and** has had an alcohol-related car accident?

$P(B \text{ and } AR) = P(B) \cdot P(AR \mid B) = (.44)(.17) = .075$

3. What's the probability that a randomly selected college student will have an alcohol-related car accident **given** they are a moderate drinker?

.09

4. What's the probability that a randomly selected college student will be a moderate drinker **and** has had no alcohol-related car accident?

$P(M) \, P(NA \mid M)$ .337

$= (.37)(.91)$

Counting Methods

Example 2. If I have 2 jackets, 4 shirts and 3 pants how many different outfits can I get?

> **Fundamental principle of counting** If a first experiment can be performed in M distinct ways, and a second experiment can be performed in N distinct ways, then the two experiments can be performed in
>
> M·N ways.

Example 3. How many 4 digit PIN's are possible when the first digit can't be repeated?

digits: 0, 1, 2, 3, 4, 5, 6, 7, 8, 9

10 9 9 9

$10 \cdot 9 \cdot 9 \cdot 9 = 7290$

Example 4. A telephone number has 10 digits:

(area code) 10 10 10 10 10 10 10

$10^7 = 10,000,000$

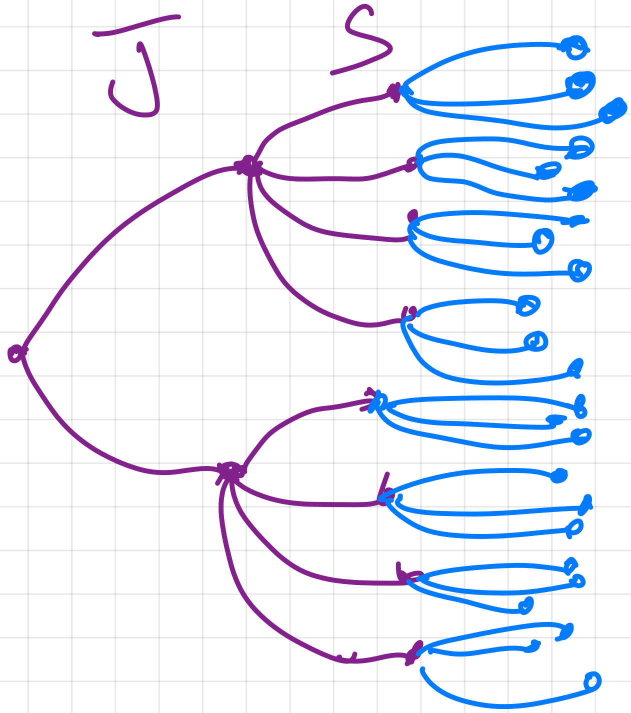
1) How many possible telephone numbers are there in each area code?

2) How many telephone numbers are there in each area code where the first digit can't begin with a 0 and the last four digits can't repeat?

( ) 9 10 10 10 9 8 7

$= 4,536,000$

2 J , 4 S, 3 , P



24 outfits

$2 \cdot 4 \cdot 3 = 24$

Example 5. How many ways can eight people line up for a photograph?

8 7 6 5 4 3 2 1

$$8 \cdot 7 \cdot 6 \cdot 5 \cdot 4 \cdot 3 \cdot 2 \cdot 1 = \underbrace{8!}_{\text{8 factorial}}$$

Factorial

$4! = 4 \cdot 3 \cdot 2 \cdot 1 = 24$

$6! = 6 \cdot 5 \cdot 4 \cdot 3 \cdot 2 \cdot 1 = 720$

Example 6. A local television station has eleven slots for commercials during a special broadcast. Six restaurants and 5 stores have bought slots for the broadcast.

(a) In how many ways can the commercials be arranged?

$11! = \ldots\ .39$ mill

(b) In how many ways can the commercials be arranged so that the restaurants are grouped together and the stores are grouped together?

Restaurants first and stores second or stores first res

$(6!) \cdot (5!) + 5! \cdot 6!$

$2\, 5! \cdot 6! = 172{,}800$

In English we use the word "combination" loosely. We say things like:

- "My fruit salad is a combination of apples, grapes and bananas"
- "The combination to the safe is 472".

When the order doesn't matter, it is a **Combination**.

When the order does matter it is a **Permutation**.

Permutations and Combinations: Consider having the letters A, B, C, D. Let's choose two of the letters.

In how many different ways can we arrange two of the 4 letters? In how many different ways can we combine two of the 4 letters?

AB BA CA DA

AC BC CB DB

AD BD CD DC

\# combinations = 6

\# permutations = 12

Permutations: We use permutations when n is the number of things to choose from, and we choose r of them, no repetitions, order matters.

Formula:

next class

bonus question on exam

Calculator instructions:

Example 7. A volleyball team has 10 players, how many 6 player starting line up are possible?

Combinations We use combination when n is the number of things to choose from, and we choose r of them, no repetition, order doesn't matter.

Formula:

Calculator instructions:

Example 8. Four lawyers are to be selected from a group of 30 lawyers to work on a project.

(a) How many different ways can the lawyers be selected to work on the project?

(b) In how many ways can the group of 4 be selected if a certain lawyer must work on the project?

Example 9. In a student club with 9 sophomores and 11 freshman members, a 5- member committee will be randomly chosen. How many ways can a committee be chosen with 3 sophomores and 2 freshmen?