Honors Advanced Algebra DATE: _____

Compound Probability Cont'd

Review Problems

1) Are the following events independent or dependent?
   a) Suppose event A is "earned a bachelor's degree" and event B is "earning more than $100,000 per year" Dependent – "income is dependent on education"
   b) Two 24 year old male drivers who live in the United States are randomly selected. Event A is "male 1 gets in a car accident during the year" and event B is "male 2 gets in a car accident during the year" Independent – Two males were randomly selected

2) Suppose you have a bag containing 2 black marbles and 3 red marbles. You reach into the bag and randomly select a marble (with replacement). Then you repeat the process one more time. Are the two events dependent or independent? What is the probability of picking a red marble both times?

you put it back in bag

What is prob. of picking "red marble" and then "red marble" again

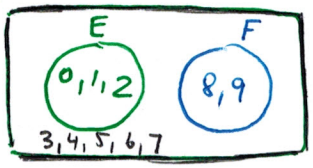
Independent

Total = 5

$$P(A \cap B) = P(A) \cdot P(B) = \frac{3}{5} \cdot \frac{3}{5} = \frac{9}{25}$$

10 #s

3) Suppose you have a bag of chips numbered 0, 1, 2, 3, 4, 5, 6, 7, 8, and 9. Let E be the event "choose a number at most 2" and F be the event "choose a number greater than 7". Draw a *Venn diagram* to represent this situation. Are these events mutually exclusive (or disjoint)? Find P(E∪F).



∪

* Notice 3,4,5,6,7 are in the complement of E∪F

The events E and F are mutually exclusive (or disjoint); they don't overlap or have anything in common.

$$P(E \cup F) = P(E) + P(F) = \frac{3}{10} + \frac{2}{10} = \frac{5}{10} = \frac{1}{2}$$

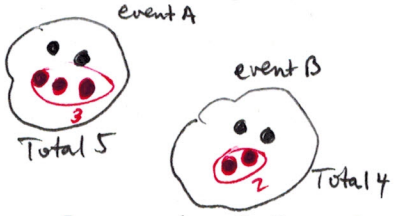
4) Suppose that a single card is selected from a standard 52-card deck. What is the probability of event A = "drawing a king" or B = "drawing a diamond"?

See sample space deck on next page. This event is NOT mutually exclusive.

P(draw king or drawing diamond) = P(draw king) + P(draw diamond) – P(king of diamonds)

$$P(A \cup B) = P(A) + P(B) - P(A \cap B) = \frac{4}{52} + \frac{13}{52} - \frac{1}{52} = \frac{4+13-1}{52} = \frac{16}{52} = \frac{4}{13}$$

5) Suppose you have a bag containing 2 black marbles and 3 red marbles. You reach into the bag and randomly select a marble (without replacement). Then you repeat the process one more time. Are the two events dependent or independent? What is the probability of picking a red marble both times?



Events are dependent since outcomes are affected when I don't put back the marble in bag.

$$P(A \cap B) = P(A) \cdot P(B) = \frac{3}{5} \cdot \frac{2}{4} = \frac{6}{20} = \frac{3}{10}$$

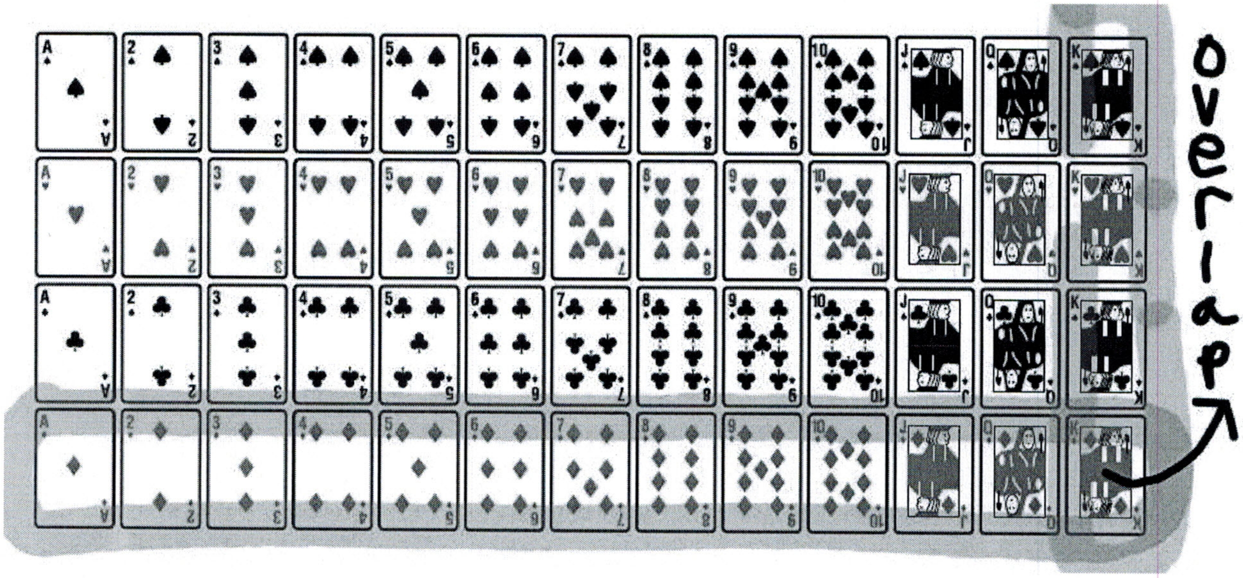
In general, an **Independent Event** occurs with replacement

and a **Dependent Event** occurs without replacement.

Explain this in your own words:

With replacement is "like putting marble back in bag"

Without replacement is "NOT putting marble back in bag"


overlap

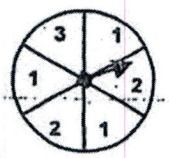
Do these problems!

Probability with Compound Events (Independent and Dependent)
Practice

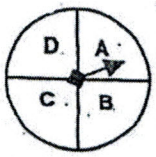
Describe the events by writing **I** for *independent event* or **D** for *dependent event*.

1. Ann draws a colored toothpick from a jar. Without replacing it, she draws a second toothpick. D
2. John rolls a six on a number cube and then flips a coin that comes up heads. I
3. Susie draws a card from a deck of cards and replaces it. She then draws a second card. I
4. Seth draws a colored tile from a bag, replaces it; draws a second tile from the bag, replaces it; and then draws a tile a third time from the bag. I
5. You draw a red marble from a bag, and then another red marble (without replacing the first marble)? D

Using the two spinners, find each **compound** probability. → All events independent



6 parts



4 parts

$P(A \cap 2)$

6. P(A and 2) $= P(A) \cdot P(2) = \frac{1}{4} \cdot \frac{2}{6} = \frac{2}{24} = \frac{1}{12}$
7. P(D and 1) $\frac{1}{8}$
   $P(D \cap 1) = P(D) \cdot P(1)$
   $= \frac{1}{4} \cdot \frac{3}{6}$
   $= \frac{3}{24} = \frac{1}{8}$
8. P(B and 3) $\frac{1}{24}$
   $P(B) \cdot P(3)$
   $= \frac{1}{4} \cdot \frac{1}{6} = \frac{1}{24}$
9. P(A and not 2) _____
   $P(A \cap 2^c) = P(A) \cdot P(2^c)$
   $= \frac{1}{4} \cdot \frac{4}{6} = \frac{4}{24} = \frac{1}{6}$

A box contains 3 red marbles, 6 blue marbles, and 1 white marble. The marbles are selected at random, one at a time, and are **not replaced**. Find each **compound** probability. → dependent events

Total 10

$P(\text{blue} \cap \text{red}) = P(\text{blue}) \cdot P(\text{red})$

10. P(blue and red) $= \frac{6}{10} \cdot \frac{3}{9} = \frac{18}{90} = \frac{1}{5}$
11. P(blue and blue) $\frac{6}{10} \cdot \frac{5}{9} = \frac{30}{90} = \frac{1}{3}$
12. P(red and white and blue) $\frac{3}{10} \cdot \frac{1}{9} \cdot \frac{6}{8} = \frac{18}{720} = \frac{1}{40}$
13. P(red and red and red) $\frac{3}{10} \cdot \frac{2}{9} \cdot \frac{1}{8} = \frac{6}{720} = \frac{1}{120}$
14. P(white and red and white) $\frac{1}{10} \cdot \frac{3}{9} \cdot \frac{0}{8} = 0$

Suppose that two tiles are drawn from the collection shown at the right. The first tile is replaced before the second is drawn. Find each **compound** probability. Independent

A	R	R	R	C
A	R	R	R	C
E	E	E	E	C

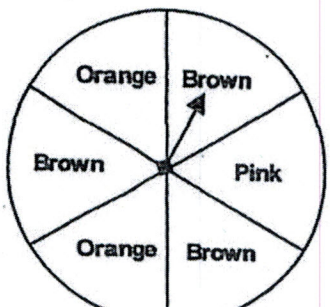
Total 15

15. P(A and A) $= \frac{2}{15} \cdot \frac{2}{15} = \frac{4}{225}$
16. P(R and C) $\frac{6}{15} \cdot \frac{3}{15} = \frac{18}{225} = \frac{6}{75} = \frac{2}{25}$
17. P(A and not R) $\frac{2}{15} \cdot \frac{9}{15} = \frac{18}{225} = \frac{2}{25}$

Suppose that two tiles are drawn from the same collection shown above. The first tile is **not** replaced before the second is drawn. Find each **compound** probability. dependent

18. P(A and A) $= \frac{2}{15} \cdot \frac{1}{15} = \frac{2}{225}$
19. P(R and C) $= \frac{6}{15} \cdot \frac{3}{14} = \frac{18}{210} = \frac{3}{35}$
20. P(A and not R) $\frac{2}{15} \cdot \frac{8}{14} = \frac{16}{210} = \frac{8}{105}$

Use the spinner to the right for the next two problems.



21. If you spin the spinner twice, what is the probability of spinning orange then brown? $P(A \cap B)$ $\frac{2}{6} \cdot \frac{3}{6} = \frac{6}{36} = \frac{1}{6}$
22. If you spin the spinner twice, what is the probability of spinning brown both times? $\frac{3}{6} \cdot \frac{3}{6} = \frac{9}{36} = \frac{1}{4}$
    $P(\text{Brown} \cap \text{Brown})$

23. Kevin had 6 nickels and 4 dimes in his pocket. If he took out one coin and then a second coin without replacing the first coin –

total 10

(a) what is the probability that both coins were nickels? $P(\text{nickle} \cap \text{nickle})$ $\frac{6}{10} \cdot \frac{5}{9} = \frac{30}{90} = \frac{1}{3}$

(b) what is the probability that both coins were dimes? $P(\text{dime} \cap \text{dime})$ $\frac{4}{10} \cdot \frac{3}{9} = \frac{12}{90} = \frac{2}{15}$

(b) what is the probability that the first coin was a nickel and the second a dime? $\frac{6}{10} \cdot \frac{4}{9} = \frac{24}{90} = \frac{4}{15}$