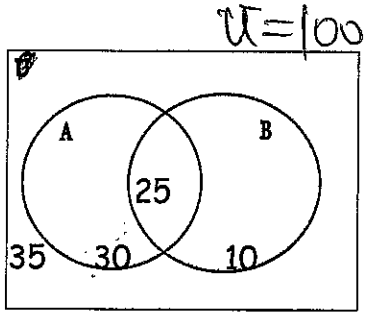
MATH 120 Section 8.2 Union, Intersection, Complement of Events & Odds

**Probability and Venn Diagrams**

1) Refer to the Venn diagram. Determine the following:




a) $P(A) = \frac{55}{100} = \frac{11}{20}$

b) $P(B) = \frac{35}{100} = \frac{7}{20}$

c) $P(A') = \frac{45}{100} = \frac{9}{20}$

d) $P(B') = \frac{65}{100} = \frac{13}{20}$

e) $P(A \cap B) = \frac{25}{100} = \frac{1}{4}$

f) $P(A \cup B) = \frac{65}{100} = \frac{13}{20}$

g) $P((A \cap B)') = \frac{75}{100} = \frac{3}{4}$ $\quad P((A \cup B)') = \frac{35}{100} = \frac{7}{20}$

**Odds**

**Example:** 2) If the chance of rain is 40%, what is the chance of no rain? 60%

Recall the probability of an event E: $P(E) = \frac{n(E)}{n(S)}$

The probability of the complement of an event: $P(E') = 1 - P(E)$

**Example:** 3) Consider the experiment of rolling a single die. Let the event be rolling a 6.

a) What is P(E)? $= \frac{1}{6}$

b) What is $P(E')$? $= \frac{5}{6}$

Odds: This is a comparison of happening: not happening for example, winning: losing

**Odds for an Event** = $P(E):P(E')$ **Odds Against an Event** = $P(E'):P(E)$

**Odds for an Event** = $\frac{P(E)}{P(E')}$ **Odds Against an Event** = $\frac{P(E')}{P(E)}$

**Examples** $P(E') = 1 - P(E)$

4) The probability that a candidate wins an election is 0.81.

a) What is the probability that he loses? $1 - 0.81 = 0.19$

b) What are the odds that he wins? $= \frac{P(E)}{P(E')} = \frac{0.81}{0.19}$ odds $\Rightarrow 81:19$

c) What are the odds that he loses? $19:81$ or $\frac{19}{81}$

5) Compute the odds in favor of

a) Obtaining an even number in a single roll of a die.

$P(E) = \frac{1}{2}$ $P(E') = \frac{1}{2}$ odds in favor $= \frac{1/2}{1/2} = \frac{1}{1}$; 1:1

b) Obtaining a sum of 7 in a single roll of two dice.

$P(E) = \frac{6}{36} = \frac{1}{6}$ $P(E') = \frac{5}{6}$ odds in favor $= \frac{1/6}{5/6} \Rightarrow \frac{1}{5}$; 1:5

6) Given the following probabilities for an event E, find the odds for and against E.

a) $P(E) = \frac{6}{11}$ $P(E') = \frac{5}{11}$ odds in favor $\frac{6/11}{5/11} = \frac{6}{5}$ odds against $= \frac{5}{6}$

b) $P(E) = \frac{7}{12}$ $P(E') \frac{12}{12} - \frac{7}{12} = \frac{5}{12}$ odds in favor $\frac{7/12}{5/12} = \frac{7}{5}$; odds against $= \frac{5}{7}$

c) P(E) = 37% = 0.37 $P(E') = 0.63$ (1 − 0.37) odds in favor $= \frac{0.37}{0.63} = \frac{37}{63}$; odds against $= \frac{63}{37}$

d) P(E) = 0.95 $P(E') = 0.05$ $P(E') = 1 - 0.95$ odds in favor $= \frac{0.95}{0.05} = \frac{95}{5} = \frac{19}{1}$

odds against $= \frac{5}{95} = \frac{1}{19}$