

# Basic Concepts of Prob. (cont.)

- **Conditional Probability :  $P(B|A)=P(A \cap B)/P(A)$** 
  - $P(A \cap B) = P(A)P(B|A) = P(B)P(A|B)$
  - So,  $P(A|B)=P(B|A)P(A)/P(B)$  (**Bayes' Rule**)
  - For independent events,  $P(A \cap B) = P(A)P(B)$ , so  $P(A|B)=P(A)$
- **Total probability: If  $A_1, \dots, A_n$  form a partition of  $S$ , then**
  - $P(B) = P(B \cap S) = P(B \cap A_1) + \dots + P(B \cap A_n)$  (why?)
  - So,  $P(A_i|B) = P(B|A_i)P(A_i)/P(B)$   
$$= P(B|A_i)P(A_i)/[P(B|A_1)P(A_1) + \dots + P(B|A_n)P(A_n)]$$
  - This allows us to compute  $P(A_i|B)$  based on  $P(B|A_i)$