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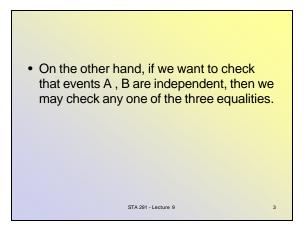
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• If we know events A and B are independent, then all 3 hold

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

- P(A|B) = P(A)
- P(B|A) = P(B)



#### How to use independence?

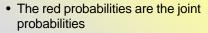
- We might give you an RxC probability table, and ask you to check if events A, B are independent. [ you need to verify one of the three identities]
- We might tell you that A, B are independent events, and ask you to compute the probability of a related event. [in the computation, you may use any of the three identities]

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	Lung Disease	Not Lung Disease	Marginal (smoke status)
Smoker	.12	.19	.31
Nonsmoker	.03	.66	.69
Marginal (disease status)	.15	.85	1.00





The green ones are the two marginal probabilities.

# Is smoking independent of lung disease?

Check one of the three equations
P(smoker) = 0.31
P(lung disease) = 0.15
joint probability P("smoker and lung disease") = 0.12

Since  $0.12 \neq 0.31 \times 0.15 = 0.0465$ Therefore the two events are not independent

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• We may also check P( lung disease | smoker ) = 0.12 / 0.31 =0.387

This is different from P(lung disease) = 0.15 (in fact this conditional probability increased a lot compared to unconditional)

Therefore "smoker", "lung disease" are *not* independent

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#### Example II

 Given that events A, B are independent, P(A) = 0.3, P(B) = 0.6.
Find P(A or B) = ?

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 $P(A \cup B) = ?$ 

• = 0.72

#### Example of independent

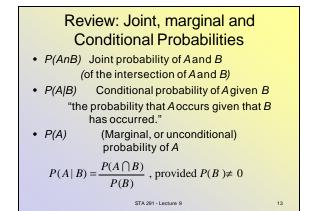
- If the table look like the next one, then the two were independent.
- There, the proportion of disease/nondisease are the same across smokers and nonsmokers.

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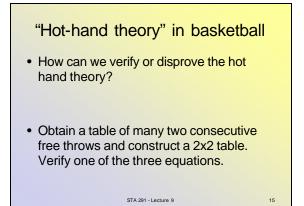
Example: Smoking and Lung Disease II independent case					
	Lung Disease	Not Lung Disease	Marginal (smoke status)		
Smoker	0.0465	0.2635	0.31		
Nonsmoker	0.1035	0.5865	0.69		
Marginal (disease status)	0.15	0.85	1.00		
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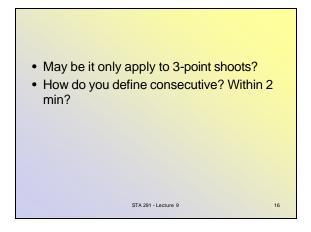
## • How did I come up with the red probabilities? (2 way street)

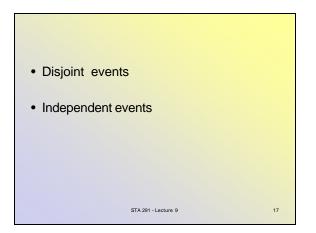
• Check for yourself that all three equations for independence are valid here.



 $P(A \cap B) = P(B \cap A)$   $A \cap B = B \cap A$   $P(B|A) = \frac{P(B \cap A)}{P(A)}, \text{ provided } P(A) \neq 0$   $P(A \cap B) = P(A) P(B|A)$ STA 291 - Lecture 9







### Chap. 6 Display and describe quantitative data

- Center and spread
- Average (mean) and median
- Range, interquartile range and standard deviation

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