Are Two Events Independent?

Part 1: Determine if the events A and B are independent based on the given information:

a) $P(A) = .4, \quad P(B) = .8, \quad P(A \cap B) = .32$

$P(A) \cdot P(B) = .4 \cdot .8 = .32$ ✓

$P(A \cap B) = .32$ ✓

Independent

b) $P(A) = \frac{1}{3} \quad P(B) = \frac{1}{5} \quad P(A \cap B) = \frac{1}{10}$

$P(A) \cdot P(B) = \frac{1}{3} \cdot \frac{1}{5} = \frac{1}{15}$

$P(A \cap B) = \frac{1}{10}$

not equal

Dependent

c) $P(A) = \frac{2}{3} \quad P(B) = \frac{1}{7} \quad P(A \cap B) = \frac{2}{21}$

$P(A) \cdot P(B) = \frac{2}{3} \cdot \frac{1}{7} = \frac{2}{21}$ ✓

$P(A \cap B) = \frac{2}{21}$ ✓

Independent

d) $P(A) = \frac{1}{2} \quad P(A|B) = .02$

$P(A) = \frac{1}{2} = .5 \quad P(A|B) = .02$

B changes the probability of A!

The events are dependent.

e) $P(B) = .25 \quad P(B|A) = 1/4$

$P(B) = .25 \quad P(B|A) = 1/4 = .25$

A does not change the probability of B. The events are independent

f) $P(B) = .40 \quad P(B|A) = 4/5$

$P(B) = .40 \quad P(B|A) = \frac{4}{5} = .80$

A changes the probability of B!

The events are dependent.

Examine the table below:

	Sleeps less than 8 hours	Sleeps 8 or more hours	Totals
Night shift	12	58	70
Day shift	14	16	30
Totals	26	74	100

A g) Find $P(Night\ Shift) =$ 70/100 = .70

B h) Find $P(Sleep\ more\ than\ 8\ hours) =$ 74/100 = .74

i) Find $P(Sleep\ more\ than\ 8\ hours\ AND\ Night\ Shift) =$ 58/100 = .58

$A \cap B$

j) Are the events "Night Shift" and "Sleeping more than 8 hours" independent? Show your work: NO! They are dependent!

$P(A) \cdot P(B)$ $\qquad$ $P(A \cap B)$

$.70 \cdot .74 = .518 \neq .58$