Section 11.2 → Contingency tables
Test for Independence between 2 categorical variables.

Drinking level	Gender: Female		Male		Totals
None	*186	(167.4)	140	(158.6)	326
Low	*661	(585.0)	478	(554.0)	1139
Moderate	*173	(242.9)	300	(230.1)	473
High	16	(40.7)	63	(38.3)	79
Totals	1036		981		2017

Expected Frequencies in parenthesis.

* There are only 3 random observed (O) frequencies the rest are derived from these.

H_0: These categorical variables are independent (Drinking level is independent of gender). (assumed true.)
H_1: The variables are dependent.

We need expected frequencies based on H_0.

Multiplication Rule from Probability:

$P(A \text{ and } B) = P(A) \cdot P(B)$ only if A & B are independent.

We assume Gender & Drinking are independent...

$$P(\text{Female and None}) = P(\text{Female}) \cdot P(\text{None}) = \frac{1036}{2017} \cdot \frac{326}{2017} = 0.0830 = 8.3\%$$

$$E = np = 2017(.083) = 2017 \cdot \frac{1036}{2017} \cdot \frac{326}{2017} = \frac{326 \cdot 1036}{2017}$$

$$E = \frac{326 \cdot 1036}{2017} = \frac{(\text{row tot.})(\text{Column tot})}{(\text{grand tot.})} = 167.4$$

$$E = \frac{(\text{row tot})(\text{col tot})}{(\text{Grand tot})}$$