

# Beer Party Example: Temperature (x) and Beer Consumption (y)

temp F	12-packs			
X	Y	X <sup>2</sup>	Y <sup>2</sup>	XY
60	10	3600	100	600
70	12	4900	144	840
80	20	6400	400	1600
90	40	8100	1600	3600
<u>300</u>	<u>82</u>	<u>23000</u>	<u>2244</u>	<u>6640</u>

$$\begin{aligned} \sum X &= 300 \\ \sum Y &= 82 \\ \sum X^2 &= 23000 \\ \sum Y^2 &= 2244 \\ \sum XY &= 6640 \end{aligned}$$

## Sum of Squares

$$SS_{xx} = \sum X^2 - \frac{(\sum X)^2}{n} = 23000 - \frac{(300)^2}{4} = 23000 - 22500 = 500$$

$$SS_{yy} = \sum Y^2 - \frac{(\sum Y)^2}{n} = 2244 - \frac{(82)^2}{4} = 2244 - 1681 = 563$$

$$SS_{xy} = \sum XY - \frac{\sum X \sum Y}{n} = 6640 - \frac{300 \cdot 82}{4} = 6640 - 6150 = 490$$

$$SS_{xx} = 500$$

$$SS_{yy} = 563$$

$$SS_{xy} = 490$$

## Linear Regression

$$\text{Slope of the line} = b_1 = \frac{SS_{xy}}{SS_{xx}} = \frac{490}{500} = 0.98$$

$$y\text{-intercept} = b_0 = \left( \frac{\sum Y}{n} \right) - b_1 \left( \frac{\sum X}{n} \right)$$

$$= \frac{82}{4} - 0.98 \left( \frac{300}{4} \right)$$

$$= 20.5 - 73.5 = -53$$

$$b_1 = 0.98$$

$$b_0 = -53$$

$$\hat{y} = b_1 X + b_0$$

$$\hat{y} = 0.98x + (-53)$$

Estimate Beer consumption when temperature = 75

$$\hat{y} = 0.98(75) + (-53) = 20.5$$