3.3 SCATTERPLOTS FOR TWO QUANTITATIVE VARIABLES

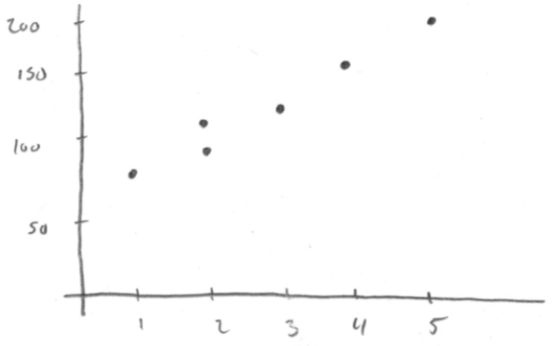
EACH EXPERIMENTAL OBSERVATION CONSISTS OF 2 MEASUREMENTS. ("BIVARIATE DATA")

e.g. SURVEY 5 HOUSEHOLDS

RECORD: # HOUSEHOLD MEMBERS (x), # $ FOR GROCERIES PER WEEK (y)

x	y
2	95
2	110
3	118
4	150
1	85
5	180

A SCATTERPLOT SHOWS EACH PAIR OF MEASUREMENTS AS A SINGLE POINT IN xy-PLANE



INTERPRET BY STATING THE TREND OBSERVED:

HOUSEHOLD GROCERY SPENDING INCREASES AS THE NUMBER OF HOUSEHOLD MEMBER INCREASE.

THIS IS CALLED A LINEAR RELATIONSHIP:

POSITIVE: $y \uparrow$ AS $x \uparrow$ OR $y \downarrow$ AS $x \downarrow$

NEGATIVE: $y \downarrow$ AS $x \uparrow$ OR $y \uparrow$ AS $x \downarrow$

THERE ARE OTHER RELATIONSHIPS, BUT WE WILL FOCUS ON LINEAR

§3.4 NUMERICAL MEASURES FOR QUANTITATIVE BIVARIATE DATA

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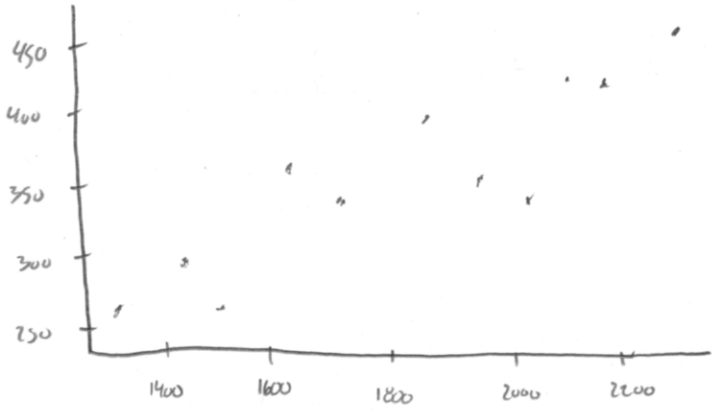
$s_x = 1.4720$

$s_y = 35.7771$

SUPPOSE 12 HOMES. MEASURE x: SIZE OF LIVING ROOM (Ft^2)

y: SELLING PRICE (THOUSANDS OF $)

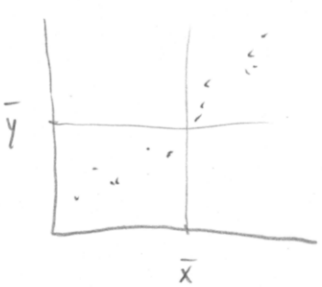
x	y
1360	278
1940	375
1750	339
1550	329
1790	295
1750	310
2230	460
1600	305
1450	295
1870	365
2210	425
1410	268



NUMERICAL MEASURE OF LINEAR RELATIONSHIP BETWEEN x & y:

CORRELATION COEFFICIENT $r = \dfrac{s_{xy}}{s_x s_y}$ WHERE $s_{xy} = \dfrac{\sum (x_i - \bar{x})(y_i - \bar{y})}{n-1}$

$s_x = \sqrt{s_x^2}$, $s_y = \sqrt{s_y^2}$



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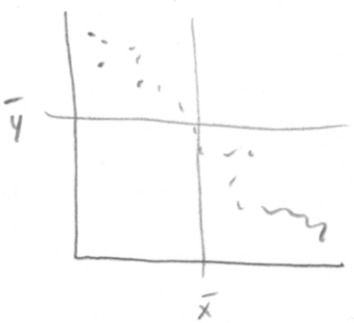

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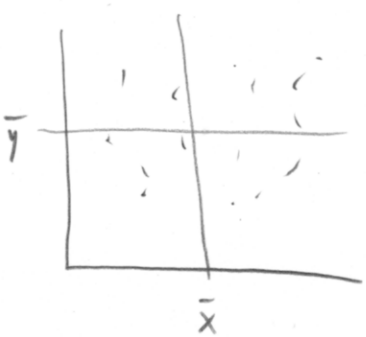

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FACT: $-1 \leq r \leq 1$

VALUES OF r CLOSE TO 1 $\Rightarrow$ STRONG POS. LIN. RELATIONSHIP BETWEEN x, y

VALUES OF r CLOSE TO -1 $\Rightarrow$ STRONG NEG. LIN. RELATIONSHIP

VALUES OF r CLOSE TO 0 $\Rightarrow$ NO APPARENT LIN. RELATIONSHIP

e.g. FIND r WHEN $s_x = 281.4842$, $s_y = 59.7592$

$s_{xy} = 15,545.1970$

BEST FITTING LINE: "REGRESSION LINE" "LEAST SQUARES LINE"

DEPENDENT ← $y = a + bx$ → INDEPENDENT

WHERE $b = r\left(\frac{s_y}{s_x}\right)$, $a = \bar{y} - b\bar{x}$

e.g. y = STARTING HOURLY WAGE

x = # YEARS WORK EXPERIENCE

x	y
2	6
3	7,5
4	8
5	12
6	13
7	15,5

$\bar{x} = 4.5$

$\bar{y} = 10.333$

$s_x = 1.871$

$s_y = 3.710$

$r = .980$

a) FIND LINEAR REG. LINE.

b) PREDICT STARTING SALARY OF WORKER WITH 9 YRS. EXPERIENCE.