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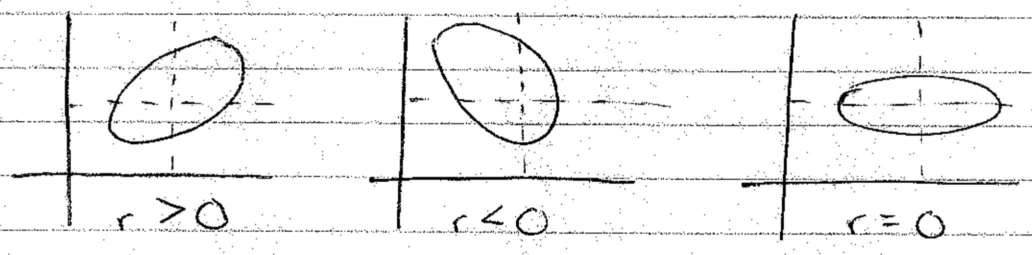
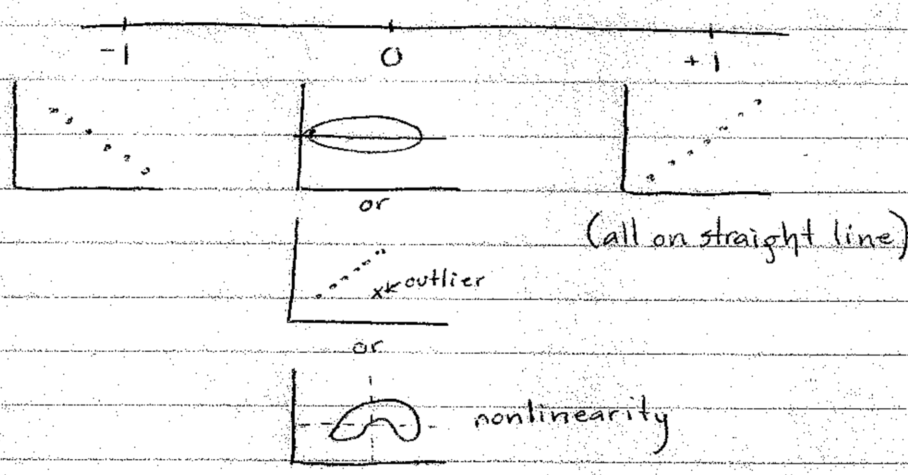
r = correlation



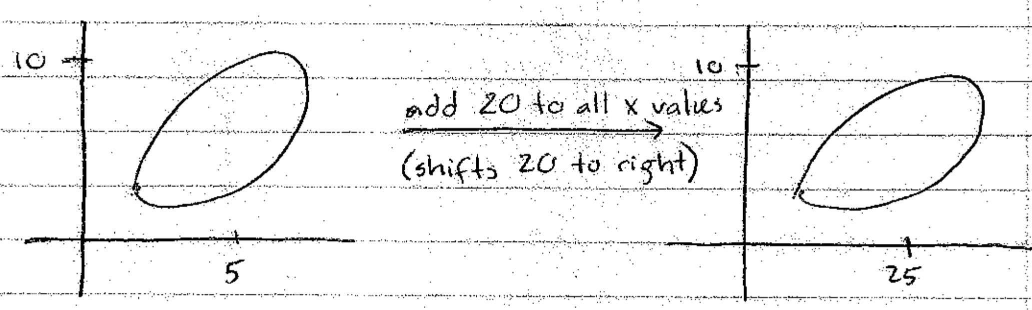
- Basic Facts about r

1) Always between -1 and +1



2) r has no units

3) Addition of constant leaves correlation unchanged



leaves r unchanged

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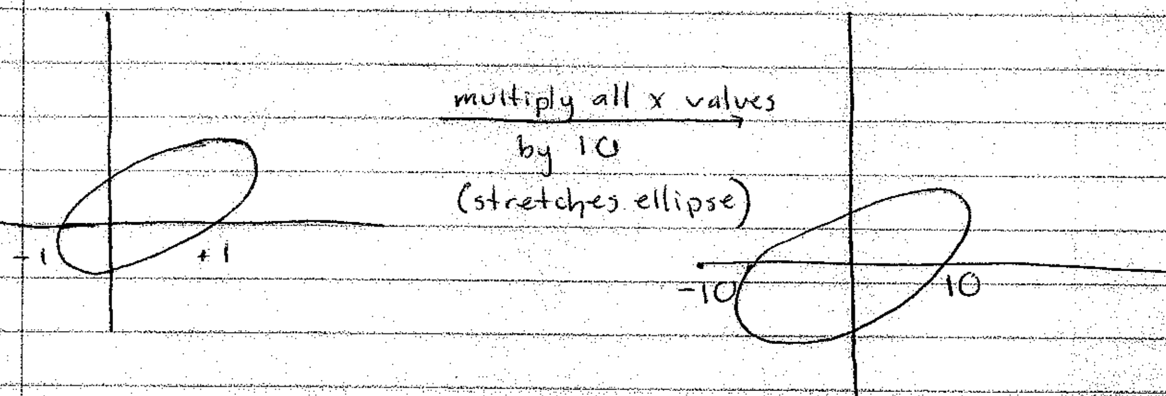
4) Multiplication leaves r unchanged



leaves r unchanged

Inference w/correlation

Is $r = .87$ practically significant?
→ Yes, info in wing length for predicting tail length. ~~or is~~

Is it large in statistical terms?

Population	Sample	Imaginary
all relevant birds of this species	observed birds	possible r's

	Population tail	Population wing	Sample tail	Sample wing	Imaginary
	y	x		($n=12$)	
mean	$\mu_y = ?$	$\mu_x = ?$	$\bar{y} = 7.6$	$\bar{x} = 10.7$	• long run mean: $E_{IID}(r) = \rho$
SD	$\sigma_y = ?$	$\sigma_x = ?$	$s_y = .35$	$s_x = .40$	• long run SD: $\widehat{SE}_{IID}(r) = .16$
corr.	$\rho = ?$		$(r) = .87$		

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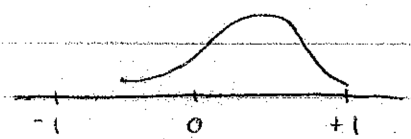
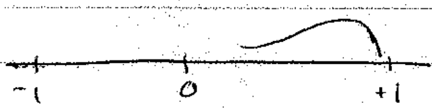
Inferential Summary

Unknown Quantity of interest	ρ = pop. corr. between wing and tail length in sparrows
estimate	$r = +.87$
Give or take for r as est. of ρ	$SE_{IID}(r) = \sqrt{\frac{1-\rho^2}{n-2}} = \hat{SE}_{IID}(r) = \sqrt{\frac{1-r^2}{n-2}} = .16$
95% CI for ρ	approx: $(.55, 1)$ exact: $(.59, .96)$

long run hist. of r:



if corr. close to zero

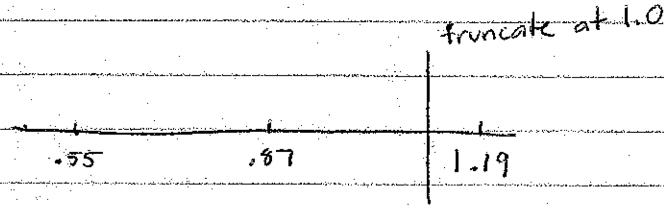


for our value (when r is big)

- Approximate 95% CI for ρ

$r \pm 1.96\, \hat{SE}(r)$

$= +.87 \pm 1.96\,(.16)$



$CI = (.55, 1)$

Correlation is large in statistical terms because 0 is not in the CI

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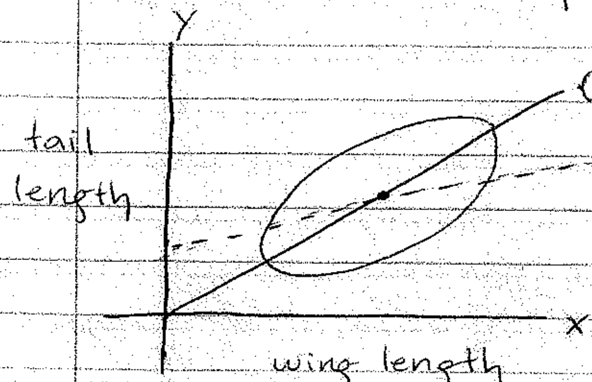
- Using x to predict y

Q_1: How do we use x to predict y?

→ Q_2: What's the equation of the best line for predicting y from x?



* Equation of best line for predicting y from x

$$\hat{y} = \hat{\beta}_0 + \hat{\beta}_1 x$$

predicted y — intercept — slope $(r(s_y/s_x))$

intercept? slope $\hat{\beta}_1 = r\, s_y/s_x$; line goes through $(\bar{x}, \bar{y})$

$$\bar{y} = \hat{\beta}_0 + \hat{\beta}_1 \bar{x}$$

$$\downarrow$$

$$\boxed{\hat{\beta}_0 = \bar{y} - \hat{\beta}_1 \bar{x}}$$