inference for a small sample mean

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PLAYING A COMPUTER GAME DURING LUNCH AFFECTS FULLNESS, MEMORY FOR LUNCH, AND LATER SNACK INTAKE

distraction and recall of food consumed and snacking

sample: 44 patients: 22 men and 22 women

study design:

- randomized into two groups:

(1) play solitaire while eating - “win as many games as possible”

(2) eat lunch without distractions

- both groups provided same amount of lunch
- offered biscuits to snack on after lunch

biscuit intake	$\bar{x}$	s	n
solitaire	52.1 g	45.1 g	22
no distraction	27.1 g	26.4 g	22

Study reference: Oldham-Cooper, Rose E., et al. "Playing a computer game during lunch affects fullness, memory for lunch, and later snack intake." The American journal of clinical nutrition 93.2 (2011): 308-313.

estimating the mean (based on a small sample)

point estimate ± margin of error

$$\bar{x} \pm t^\star_{df} SE_{\bar{x}}$$

$$\bar{x} \pm t^\star_{df} \frac{s}{\sqrt{n}}$$

$$\bar{x} \pm t^\star_{n-1} \frac{s}{\sqrt{n}}$$

Degrees of freedom for t statistic

for inference on one sample mean

$$df = n - 1$$

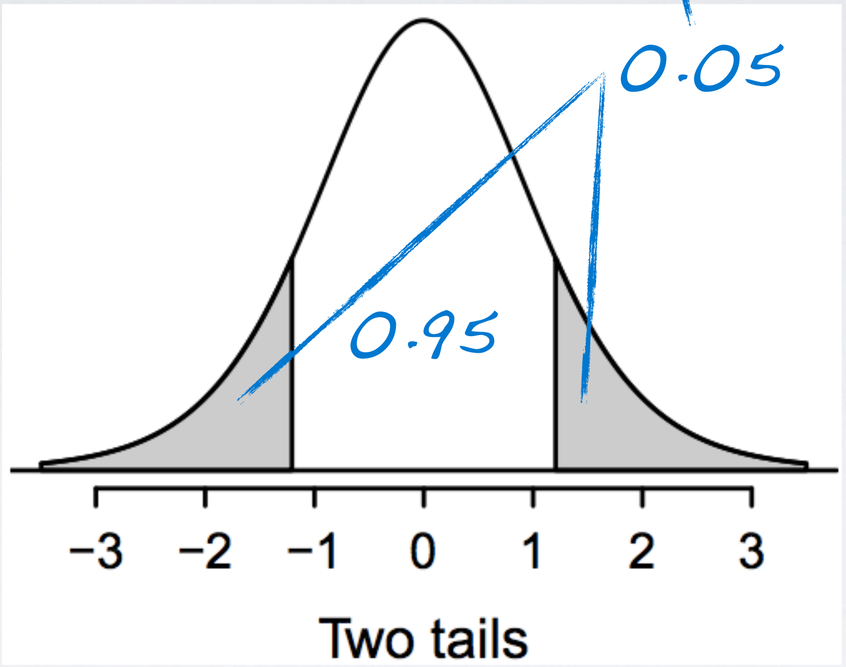
finding the critical t score

using the table

1. determine df

$df = 22 - 1 = 21$

2. find corresponding tail area for desired confidence level



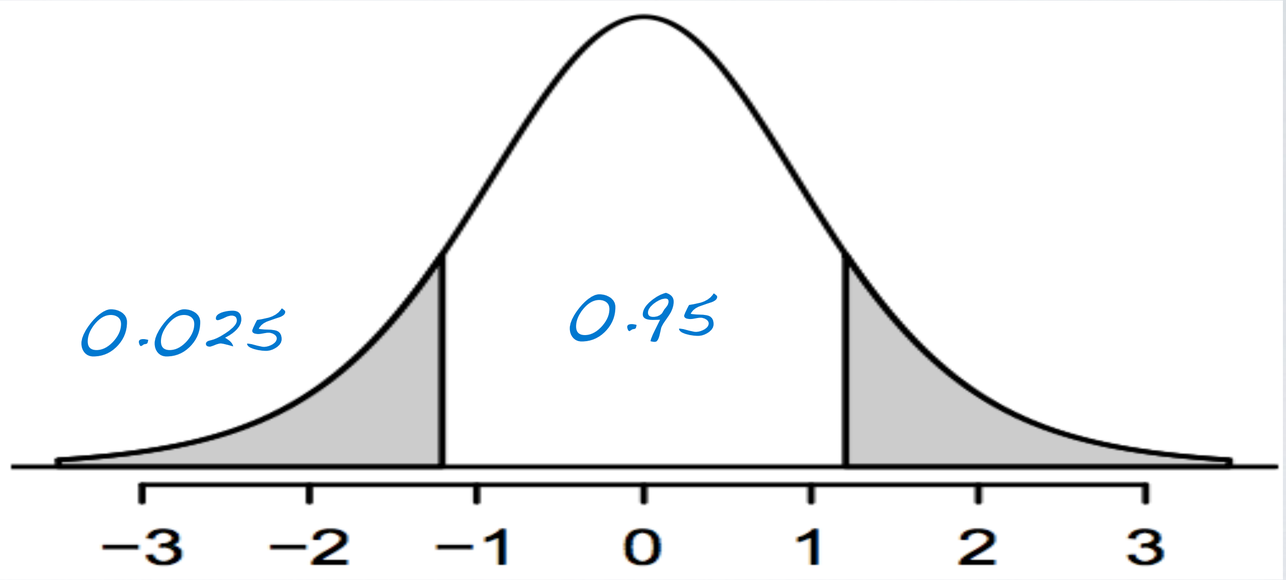
one tail		0.100	0.050	0.025	0.010	0.005
two tails		0.200	0.100	0.050	0.020	0.010
df	1	3.08	6.31	12.71	31.82	63.66
	2	1.89	2.92	4.30	6.96	9.92
	3	1.64	2.35	3.18	4.54	5.84
	4	1.53	2.13	2.78	3.75	4.60
	5	1.48	2.02	2.57	3.36	4.03
	6	1.44	1.94	2.45	3.14	3.71
	7	1.41	1.89	2.36	3.00	3.50
	8	1.40	1.86	2.31	2.90	3.36
	9	1.38	1.83	2.26	2.82	3.25
	10	1.37	1.81	2.23	2.76	3.17
	11	1.36	1.80	2.20	2.72	3.11
	12	1.36	1.78	2.18	2.68	3.05
	13	1.35	1.77	2.16	2.65	3.01
	14	1.35	1.76	2.14	2.62	2.98
	15	1.34	1.75	2.13	2.60	2.95
	16	1.34	1.75	2.12	2.58	2.92
	17	1.33	1.74	2.11	2.57	2.90
	18	1.33	1.73	2.10	2.55	2.88
	19	1.33	1.73	2.09	2.54	2.86
	20	1.33	1.72	2.09	2.53	2.85
	21	1.32	1.72	2.08	2.52	2.83
	22	1.32	1.72	2.07	2.51	2.82
	23	1.32	1.71	2.07	2.50	2.81
	24	1.32	1.71	2.06	2.49	2.80
	25	1.32	1.71	2.06	2.49	2.79
	26	1.31	1.71	2.06	2.48	2.78
	27	1.31	1.70	2.05	2.47	2.77

finding the critical t score

using R

R

```
> qt(0.025, df = 21)
[1] -2.079614
```



practice

Estimate the average after-lunch snack consumption (in grams) of people who eat lunch **distracted** using a 95% confidence interval.

$$\bar{x} = 52.1\ g$$
$$s = 45.1\ g$$
$$n = 22$$
$$t^\star_{21} = 2.08$$

$\bar{x} \pm t^* SE = 52.1 \pm 2.08 \times \frac{45.1}{\sqrt{22}}$

$= 52.1 \pm 2.08 \times 9.62$

$= 52.1 \pm 20 \quad = (32.1, 72.1)$

We are 95% confident that distracted eaters consume between 32.1 to 72.1 grams of snacks post-meal.

practice

Suppose the suggested serving size of these biscuits is 30 g. Do these data provide convincing evidence that the amount of snacks consumed by distracted eaters post-lunch is different than the suggested serving size?

$\bar{x} = 52.1\ g$

$s = 45.1\ g$

$n = 22$

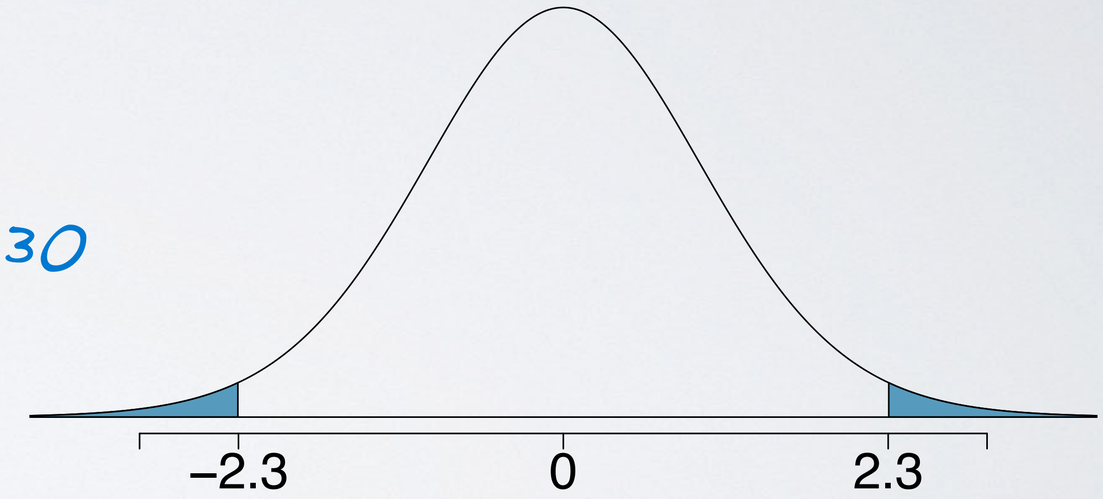
$SE = 9.62$

$H_0: \mu = 30$

$H_A: \mu \neq 30$

$$T = \frac{52.1 - 30}{9.62} = 2.30$$

$df = 22 - 1 = 21$



finding the p-value

using the table

1. determine df

df = 21

2. locate the calculated T score in the df row

3. grab the one or two tail p-value from the top row

0.02 < p-value < 0.05

one tail		0.100	0.050	0.025	0.010	0.005
two tails		0.200	0.100	0.050	0.020	0.010
df	1	3.08	6.31	12.71	31.82	63.66
	2	1.89	2.92	4.30	6.96	9.92
	3	1.64	2.35	3.18	4.54	5.84
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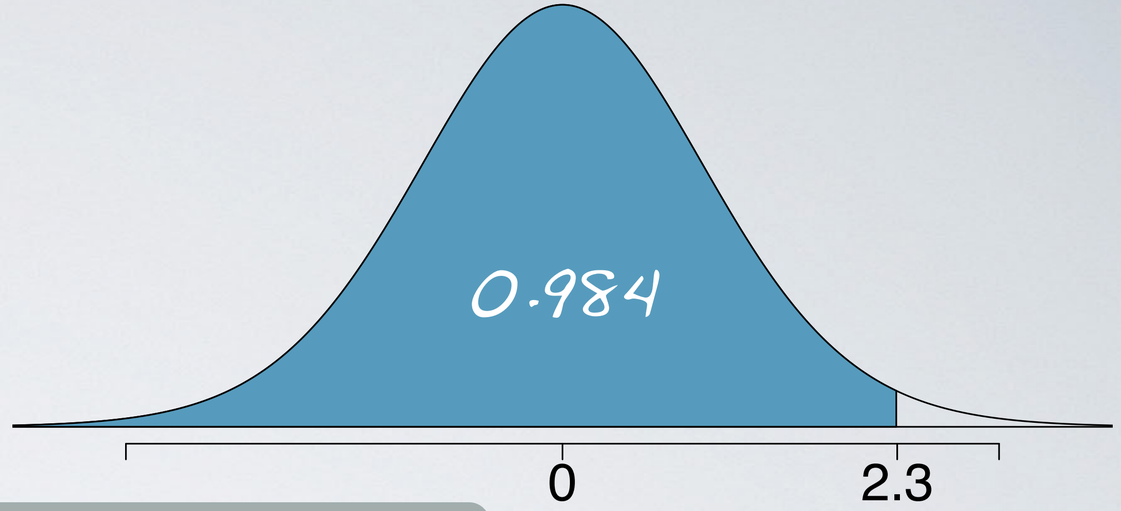
finding the p-value

using R



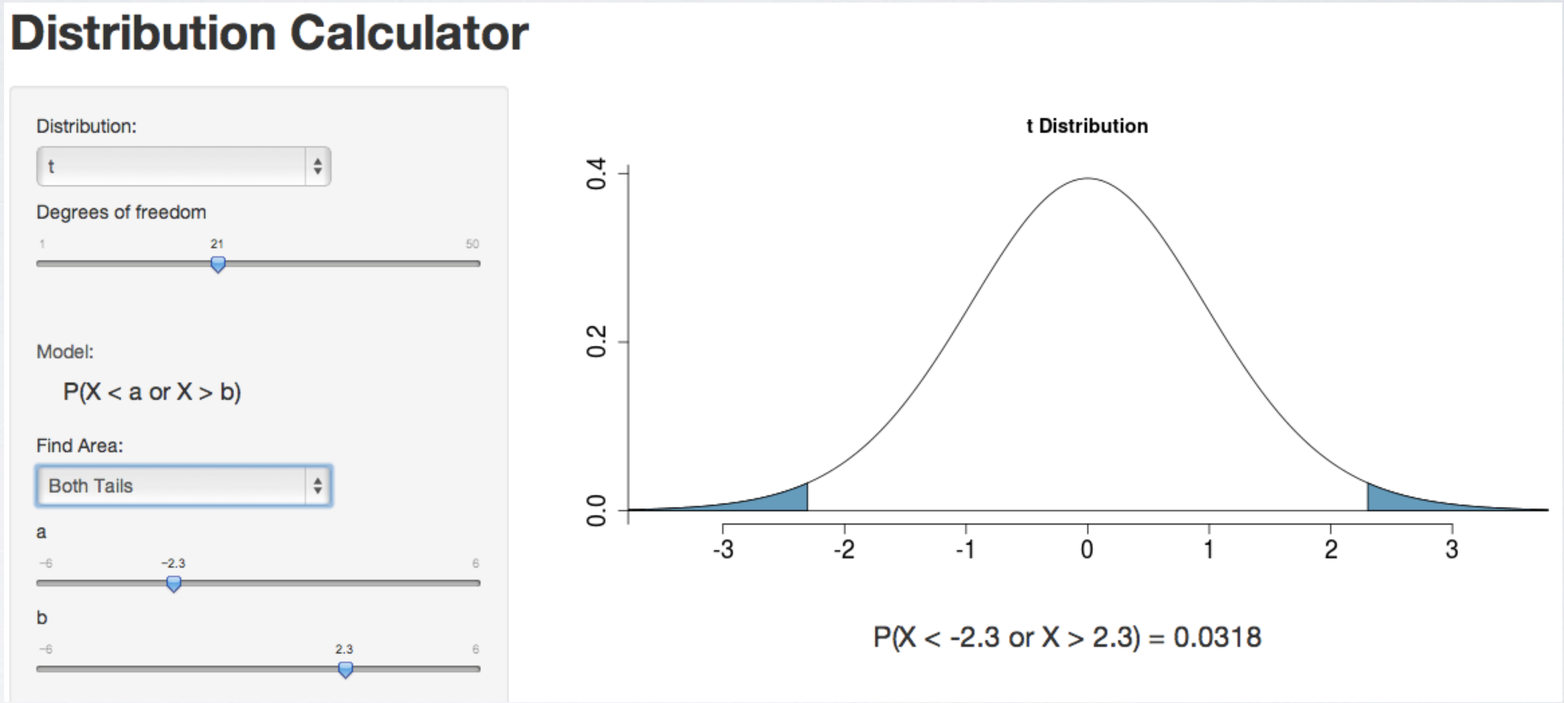
R

```
> pt(2.30, df = 21)

[1] 0.9840989

> 2 * pt(2.30, df = 21, lower.tail = FALSE)

[1] 0.03180228
```

finding the p-value

using the applet

http://bitly.com/dist_calc



recap

$$\bar{x} = 52.1\ g$$

$$s = 45.1\ g$$

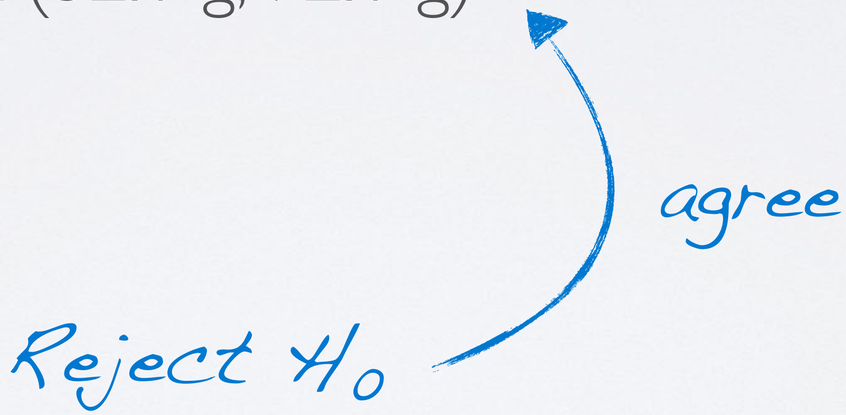
$$n = 22$$

95% confidence interval: (32.1 g, 72.1 g)

$$H_0 : \mu = 30$$

$$H_A : \mu \neq 30$$

p-value $\approx$ 0.0318



conditions

- independent observations
  - random assignment
  - 22 < 10% of all distracted eaters
- sample size / skew

$$\bar{x} = 52.1\ g$$

$$s = 45.1\ g$$

$$n = 22$$