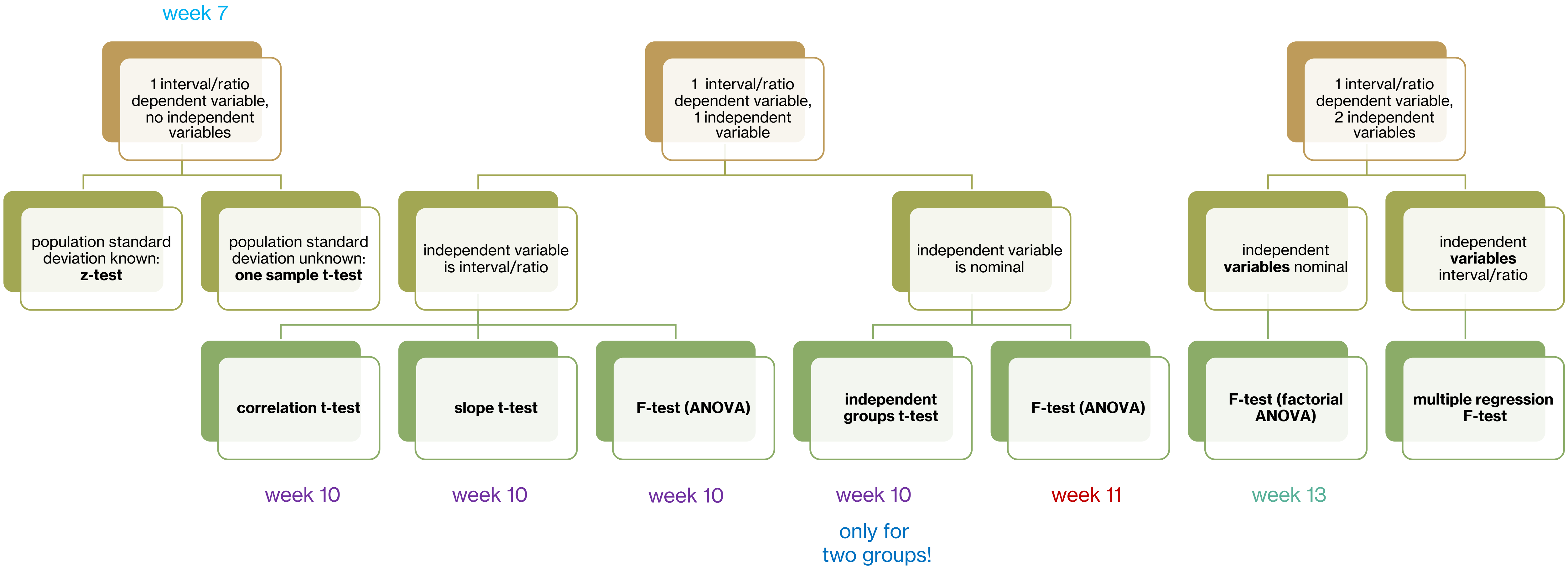
DATA ANALYSIS

Hypothesis tests collection

overall framework (all between-subject designs so far)



z-test

one DV, no IV

population standard deviation known

step 1: state the hypotheses

step 2: set criteria for decision

step 3: collect data

step 4: make a decision!

Step 1:

$H_0: \mu = 80$

$H_1: \mu \neq 80$

compute μ and $\sigma_M = \frac{\sigma}{\sqrt{n}}$ for sampling distribution under H_0

Step 2:

$\alpha = .05$

find $z_{critical}$ based on one vs. two tailed test

Step 3:

(1) compute $z_{observed} = \frac{M - \mu}{\sigma_M}$

(2) find p-value for z-score

Step 4:

check whether $z_{observed}$ is beyond $z_{critical}$ and p-value < .05. if so, reject null hypothesis!

one sample t-test

one DV, no IV

population standard deviation **unknown**

step 1: state the hypotheses

step 2: set criteria for decision

step 3: collect data

step 4: make a decision!

$H_0: \mu = 80$
$H_1: \mu \neq 80$
compute μ for sampling distribution of means under H_0

$\alpha = .05$
find $t_{critical}$ based on one vs. two tailed test and degrees of freedom = $n - 1$

(1) compute sample standard deviation (s)

(2) compute $s_M = \frac{s}{\sqrt{n}}$

(3) compute $t_{observed} = \frac{M - \mu}{s_M}$

(4) find p-value for t-score

check whether $t_{observed}$ is beyond $t_{critical}$ and p-value < .05. if so, reject null hypothesis!

correlation t-test

one DV, one IV
interval/ratio IV

step 1: state the hypotheses

step 2: set criteria for decision

step 3: collect data

step 4: make a decision!

step 1:
$H_0: \rho = 0$
$H_1: \rho \neq 0$
compute μ for sampling distribution of correlations under H_0

step 2:
$\alpha = .05$
find $t_{critical}$ based on one vs. two tailed test and degrees of freedom = $n - 2$

step 3:
(1) compute correlation r
(2) compute $SE_r = \sqrt{\frac{1-r^2}{n-2}}$
(3) compute $t_{observed} = \frac{r - \rho}{SE_r}$
(4) find p-value for t-score

step 4:
check whether $t_{observed}$ is beyond $t_{critical}$ and p-value < .05. if so, reject null hypothesis!

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slope t-test

one DV, one IV

interval/ratio IV

step 1: state the hypotheses

step 2: set criteria for decision

step 3: collect data

step 4: make a decision!

$H_0: \beta = 0$
$H_1: \beta \neq 0$
compute μ for sampling distribution of slopes under H_0

$\alpha = .05$
find $t_{critical}$ based on one vs. two tailed test and degrees of freedom = $n - 2$

(1) compute correlation r
(2) compute $b = r\,\frac{s_y}{s_x}$
(3) compute $SE_b = SE_r\,\frac{s_y}{s_x}$
(2) compute $t_{observed} = \frac{b-\beta}{SE_b}$
(3) find p-value for t-score

check whether $t_{observed}$ is beyond $t_{critical}$ and p-value < .05. if so, reject null hypothesis!

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linear regression: F-test

one DV, one IV
interval/ratio IV

step 1: state the hypotheses

step 2: set criteria for decision

step 3: collect data

step 4: make a decision!

$H_0: \beta = 0$
$H_1: \beta \neq 0$

$\alpha = .05$
find $F_{critical}$ based on **right** tailed test and
degrees of freedom
$df_1 = k - 1$
$df_2 = n - k$
$k = 2$ for simple linear regression

(1) compute correlation r
(2) compute $b = r \frac{s_y}{s_x}$
(3) compute $a = M_y - bM_x$
(4) compute $\hat{Y} = a + bX$
(5) compute $SS_{total} = \sum(Y - M_y)^2$
(6) compute $SS_{error} = \sum(Y - \hat{Y})^2$
(7) compute $SS_{model} = SS_{total} - SS_{error}$
(8) compute $F_{observed} = \frac{MS_{model}}{MS_{error}}$
(9) find p-value for F-score

check whether $F_{observed}$ is beyond $F_{critical}$ and p-value < .05. if so, reject null hypothesis!

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two independent groups t-test

one DV, one IV

nominal IV with ONLY TWO levels

step 1: state the hypotheses

step 2: set criteria for decision

step 3: collect data

step 4: make a decision!

H_0: β = 0 or $\mu_2 - \mu_1 = 0$

H_1: β ≠ 0 or $\mu_2 - \mu_1 \neq 0$

$\alpha = .05$
find $t_{critical}$ based on one vs. two tailed test and degrees of freedom
$df = n_1 + n_2 - 2$

(1) compute $s_p{}^2 = \frac{SS_1 + SS_2}{df_1 + df_2}$

(2) compute $s_{M2-M1} = \sqrt{\frac{s_p{}^2}{n_1} + \frac{s_p{}^2}{n_2}}$

(3) compute $b = M_2 - M_1$

(4) compute $t_{observed} = \frac{b - \beta}{s_{M2-M1}}$

(3) find p-value for t-score

check whether $t_{observed}$ is beyond $t_{critical}$ and p-value < .05. if so, reject null hypothesis!

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two independent groups F-test

one DV, one IV

nominal IV with ONLY TWO levels

step 1: state the hypotheses

step 2: set criteria for decision

step 3: collect data

step 4: make a decision!

$H_0: \mu_2 - \mu_1 = 0$
$H_1: \mu_2 - \mu_1 \neq 0$

$\alpha = .05$
find $F_{critical}$ based on **right** tailed test and degrees of freedom
$df_1 = k - 1$
$df_2 = n - k$
$k = 2$ for IV with only two levels

(1) compute grand mean M_Y
(2) compute $SS_{total} = \sum(Y - M_Y)^2$
(3) compute $SS_{error} = \sum(Y - M_{group})^2$
(4) compute $SS_{model} = SS_{total} - SS_{error}$

(2) compute $F_{observed} = \frac{MS_{model}}{MS_{error}} = \frac{SS_{model}/df_{model}}{SS_{error}/df_{error}}$

(3) find p-value for F-score

check whether F is beyond $F_{critical}$ and p-value < .05. if so, reject null hypothesis!

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one-way ANOVA / F-test

one DV, one IV

nominal IV with ANY number of levels

step 1: state the hypotheses

step 2: set criteria for decision

step 3: collect data

step 4: make a decision!

$H_0: \mu_1 = \mu_2 = \cdots = \mu_n$

$H_1: at\ least\ one\ mean\ difference$

$\alpha = .05$

find $F_{critical}$ based on **right** tailed test and degrees of freedom

$df_1 = k - 1$

$df_2 = n - k$

$k = 2$ for IV with only two levels

(1) compute grand mean M_Y

(2) compute $SS_{total} = \sum(Y - M_Y)^2$

(3) compute $SS_{error} = \sum(Y - M_{group})^2$

(4) compute $SS_{model} = SS_{total} - SS_{error}$

(2) compute $F_{observed} = \frac{MS_{model}}{MS_{error}} = \frac{SS_{model}/df_{model}}{SS_{error}/df_{error}}$

(3) find p-value for F-score

check whether F is beyond $F_{critical}$ and p-value < .05. if so, reject null hypothesis!

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