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Solutions: Chapter 11 Problems 1, 11, 15, 19, 34, 35, 46

Problem 1.

a) $\bar{X} = 0.5546$, $\bar{Y} = 1.6240$, $\bar{Y} - \bar{X} = 1.0694$

b) $s_x^2 = 0.2163$, $s_y^2 = 1.1795$, $s_p^2 = 0.7667$

c) $s_{\bar{y}-\bar{x}} = 0.5874$

d) exact 90% CI for $(\mu_y - \mu_x)$ is 1.0694 ± 1.1128

e) two-sided

f) observed $T = 1.8206$, df $= 7$, two-sided $P = 0.1115$ [=2*tcdf(-1.8206,7)]

g) no

h)

b: $\sigma^2 = 1$, c: $s_{\bar{y}-\bar{x}} = 0.0.6708$, d: 1.0694 ± 1.1035,
f: $Z = 1.5942$ two-sided $P = 0.11$, g: no

Problem 15.

Approximate 95% CI for $(\mu_x - \mu_y)$ is $\bar{X} - \bar{Y} \pm 1.96 \cdot 10 \cdot \sqrt{\frac{2}{n}}$.
CI width $2 = 55.44/\sqrt{n}$. Thus $n \approx 768$.

Problem 19.

a) $\bar{X} = 10.693$, $\bar{Y} = 6.750$, $s_x^2 = 23.226$, $s_y^2 = 12.978$, $s_{\bar{x}-\bar{y}} = \sqrt{s_{\bar{x}}^2 + s_{\bar{y}}^2} = 1.903$, observed $T = 2.072$, df $= 18$, two-sided $P = 0.053$ [=2*tcdf(-2.072,18)] assuming equal variances

b) Ranks in the pooled sample

X : 1, 8, 9, 11, 13, 14, 17, 18, 19, 20
Y : 2, 3, 4, 5, 6, 7, 10, 12, 15, 16

Wilcoxon rank sum test $R_x = 130$, $R_y = 80$, two-sided $0.05 < P < 0.10$ [see page A22].

c) Nonparametric since both normplot(x) and normplot(y) show non-normality of the data distribution

d) Order in the pooled sample x-yyyyyy-xx-y-x-y-xx-yy-xxxx
$P(X < Y) \approx \frac{\text{number of } (x_i < y_j)}{\text{total number of pairs } (x_i, y_j)} = \frac{10+4+4+3+2+2}{100} = 0.25$ implies $\hat{\pi} = 0.75$

e) The matlab commands

u=x(random('unid',10,10,1000));

v=y(random('unid',10,10,1000));
N=zeros(1,1000);
for k=1:1000 for i=1:10 for j=1:10
N(k)=N(k)+(u(i,k)>v(j,k));
end,end,end
P=N/100;
hist(P,20)
std(P)

estimate the sampling distribution of $\hat{\pi}$ with $s_{\hat{\pi}} = 0.1187$.

f) Matlab commands
c1=prctile(P,5)
c2=prctile(P,95)

give a 90% CI for π: $(2\hat{\pi} - c2; 2\hat{\pi} - c1) = (0.58; 0.96)$.

Problem 34.

$\bar{X} = 85.26$, $s_x = 21.20$, $s_{\bar{x}} = 5.47$, $n = 15$
$\bar{Y} = 84.82$, $s_y = 21.55$, $s_{\bar{y}} = 5.57$, $m = 15$
$\bar{D} = \bar{X} - \bar{Y} = 0.44$

Paired samples $s_d = 4.63$, $s_{\bar{d}} = 1.20$
Independent samples $s_{\bar{x}-\bar{y}} = 7.81$

To test $H_0 : \mu_x = \mu_y$ against $H_1 : \mu_x \neq \mu_y$ assume $D \in \mathrm{N}(\mu, \sigma^2)$ and apply one-sample t-test
$T = \frac{\bar{D}}{s_{\bar{d}}} = 0.368$, df $= 14$, two-sided $P = 0.718$, can not reject H_0.

Without normality assumption apply the Wilcoxon signed rank test. Matlab command signrank(x,y)
computes the two-sided $P = 0.604$. We can not reject H_0.

Problem 46.

a) room with a window $\leftarrow$ rich patient $\rightarrow$ recovers faster

b) smoker $\leftarrow$ loser $\rightarrow$ wife gets cancer

c) no breakfast $\leftarrow$ lack of discipline $\rightarrow$ accident

d) choose to change the school $\leftarrow$ lower grades before $\rightarrow$ lower grades after

e), i) ?

f) abstain from alcohol $\leftarrow$ poor health

g) marijuana $\leftarrow$ schizophrenia

h) total time together = time before wedding + time after wedding