1. We first turn the answers into a table. We then apply McNemar's test.

		B		
		Right	Wrong	
A	Right	5	3	8
	Wrong	0	0	0
		5	3	

questions w/ disagreement

$H_0: p_A = p_B$ vs $H_a: p_A > p_B$

<u>TS:</u> $B = 3$ times that A was right when A + B disagreed.

Here p-value $= P(B \geq 3 \mid B \sim Bin(3, \tfrac{1}{2}))$

$= P(B = 3) = (\tfrac{1}{2})^3 = 1/8.$

<u>Concl:</u> Since $\frac{1}{8} < 0.2$, we $\boxed{\text{reject } H_0.}$ We have sufficient evidence to conclude at level .20 that student A is more likely to answer correctly than is student B.

2. We use Kendall's test.

H_0: years of experience and salary are independent vs

H_a: years of experience + salary are positively associated

$C = \#$ of concordant pairs $= 3 + 1 + 1 = 5 \implies$

$r_\tau = 2\left(\frac{5}{\binom{4}{2}}\right) - 1 = 2\left(\frac{5}{6}\right) - 1 = 2/3.$

from Table A13

p-value $= P(r_\tau \geq 2/3 \mid H_0) = .167.$

<u>Concl:</u> Since $.167 > 0.10$, we $\boxed{\text{retain } H_0.}$ We don't have sufficient evidence to conclude at level .10 that years of experience and salary are positively associated.

3. We look at the pairwise slopes.

Pair	Slope
(1,2)	$\frac{9000}{4} = 2{,}250$
(1,3)	$\frac{7000}{6} = 1{,}167$
(1,4)	$\frac{24{,}000}{19} = 1{,}263$
(2,3)	$\frac{-12000}{2} = -1{,}000$
(2,4)	$\frac{15{,}000}{15} = 1{,}000$
(3,4)	$\frac{17{,}000}{13} = 1{,}308$

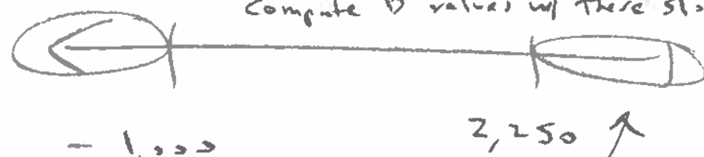
By the table,

$P(r_\tau \geq 1) = 0.042 < 0.05$,

but $P(r_\tau \geq 0.67) = 0.167 > 0.05$.

Thus, we can drop only the most extreme intervals on the upper + lower end.

drop since $r_\tau = 1$ when we compute D values w/ these slopes



drop since $r_\tau = -1$ when we compute D values w/ these slopes

We are 90% confident that the slope of the regression line relating expected salary to years of experience is between −1,000 and 2,250.

Exact coverage: $1 - 2(.042) = 0.916$ or $\boxed{91.6\%}$

4 a We look at the Bin(12, 0.5) distribution.

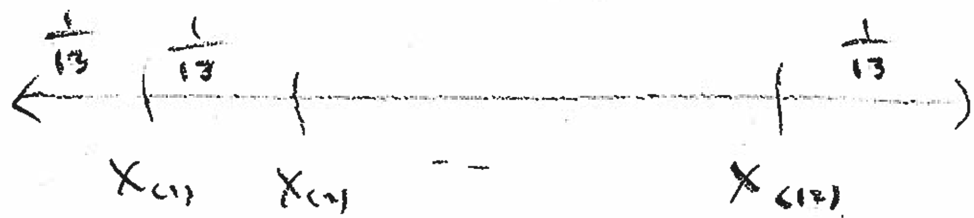
$P(X \le 3) \cong 0.0002 + 0.0029 + 0.0161 + 0.0537 \cong 0.073 < 0.1$,

but $P(X \le 4) > .10$. Thus, we use the interval

4th smallest to 4th biggest $\rightarrow$ $(X_{(4)}, X_{(9)}) = \boxed{(92, 99)}$ as a 80% CI for the median. The exact coverage is approximately

$1 - 2(.073) = 0.854$.

b



The interval $(X_{(1)}, X_{(12)}) = \boxed{(69, 117)}$ has exact coverage $\boxed{\frac{11}{13}} > 0.8$. Thus, we use this interval as an 80% prediction interval for the length of the next issue.

About 84.6%.

$\binom{5}{3} = 10$ possibilities

5

First sample ranks	Sum of squares
1, 2, 3	$1^2+2^2+3^2=14$
1, 2, 4	$1^2+2^2+4^2=21$
1, 2, 5	$1^2+2^2+5^2=30$
1, 3, 4	$1^2+3^2+4^2=26$
1, 3, 5	$1^2+3^2+5^2=35$
1, 4, 5	$1^2+4^2+5^2=42$
2, 3, 4	$2^2+3^2+4^2=29$
2, 3, 5	$2^2+3^2+5^2=38$
2, 4, 5	$2^2+4^2+5^2=45$
3, 4, 5	$3^2+4^2+5^2=50$

All equally likely.

Value	Prob
14	0.1
21	0.1
26	0.1
29	0.1
30	0.1
35	0.1
38	0.1
42	0.1
45	0.1
50	0.1

6

a $H_0: \underbrace{\Delta = 0}_{\text{no shift}}$ vs $H_a: \underbrace{\Delta \neq 0}_{\text{some shift}}$

(same median for A + B) (different medians)

A	212 (11)	178 (5)	209 (9)	226 (12)	203 (8)	194 (7)	← ranks
B	174 (4)	184 (6)	165 (3)	210 (10)	150 (1)	153 (2)	← ranks

$W = 11 + 5 + 9 + 12 + 8 + 7 = 52.$

Critical values: 28 + 50 for level .10 (two-sided)

Since $W \geq 50$, we $\boxed{\text{reject } H_0}$ + conclude that there is a difference between the median corn yields for the two varieties.

b Sequence: absolute difference 2/3

$\hat{F}_B$ →	0	$\frac{1}{6}$	$\frac{1}{3}$	$\frac{1}{2}$	$\frac{2}{3}$	$\frac{2}{3}$	$\frac{5}{6}$	$\frac{5}{6}$	$\frac{5}{6}$	$\frac{5}{6}$	1	1	1
		B	B	B	B	A	B	A	A	A	B	A	A
$\hat{F}_A$ →	0	0	0	0	0	$\frac{1}{6}$	$\frac{1}{6}$	$\frac{1}{3}$	$\frac{1}{2}$	$\frac{2}{3}$	$\frac{2}{3}$	$\frac{5}{6}$	1

$$D_{KS} = \max_t |\hat{F}_B(t) - \hat{F}_A(t)| = \boxed{2/3}$$

(7) There are $2^2 \times 2^2 = 16$ possibilities to consider.

First	Second	$\bar{x}_1 - \bar{x}_2$
2, 2	6, 6	−4
	6, 8	−5
	8, 6	−5
	8, 8	−6
2, 4	6, 6	−3
	6, 8	−4
	8, 6	−4
	8, 8	−5
4, 2	6, 6	−3
	6, 8	−4
	8, 6	−4
	8, 8	−5
4, 4	6, 6	−2
	6, 8	−3
	8, 6	−3
	8, 8	−4

$\bar{x}_1 - \bar{x}_2$	Prob
−6	$\frac{1}{16}$
−5	$\frac{4}{16} = \frac{1}{4}$
−4	$\frac{6}{16} = \frac{3}{8}$
−3	$\frac{4}{16} = \frac{1}{4}$
−2	$\frac{1}{16}$

8 The normal-theory approach is the $\boxed{\text{ANOVA F test.}}$

Here we assume that the observations follow a model $Y_{ij} = \mu_i + \varepsilon_{ij}$, where the ε_{ij} values are iid $N(0, \sigma^2)$ random variables.

Here Y_{ij} is the jth obs. on the ith formulation.

One nonparametric alternative is to do a $\boxed{\text{permutation F test.}}$ Here we no longer need to assume that the ε_{ij} values are normal, but ~~we still need~~ them to be iid.

These require fewer assumptions.

Another nonparametric alternative is the Kruskal-Wallis test. We must assume that the ε_{ij} values are iid, but they need not be normal.

In the two nonparametric approaches, the ε_{ij} values need not even have a mean or variance, but they must be iid.

9

X	rank	Y	rank
−2	1	1	2
−1	2	2	3
0	3	3	4
1	4	−100	1
2	5	4	5

Spearman numerator: $n \sum R_x R_y - \sum R_x \sum R_y$

$= 5(49) - 15^2 = 20 > 0$

$\Longrightarrow \boxed{r_s > 0.}$

Pearson numerator: $n \sum xy - (\sum x)(\sum y)$

$= 5(-96) - 0(-90) < 0$

$\Longrightarrow \boxed{r < 0.}$

8

(10) The Ansari-Bradley test and the rank sum test use different rank scores. Thus, it is definitely possible for them to yield different results. The A-B test is designed to be sensitive to differences in scale, while the rank sum test is designed to be sensitive to differences in location.

Having the A-B test reject equility while the rank sum test does not suggests that the major difference between the two populations may be a difference in scale.