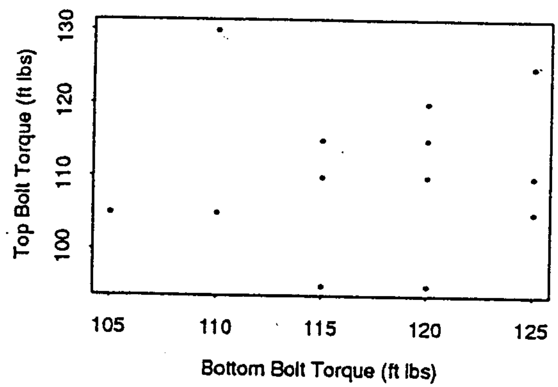
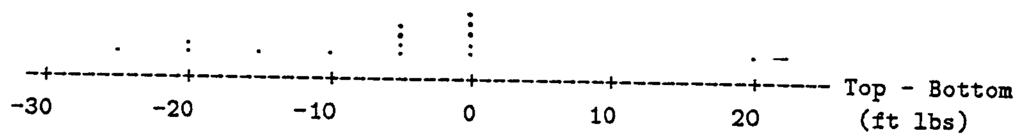
Stat 305 HW#3 Solutions

P77. 3. (a)



There are no obvious patterns.

(b) The differences are −15, 0, −20, 0, −5, 0, −5, 0, −5, 20, −25, −5, −10, −20, and 0.



The dot diagram shows that most of the differences are zero or negative and "truncated" at zero. The exception is the 10th piece of equipment, with a difference of 20. This point does not fit in with the shape of the rest of the differences, so it is an outlier. Since most of the differences are zero or negative, the bottom bolt generally required more torque to loosen than the top bolt.

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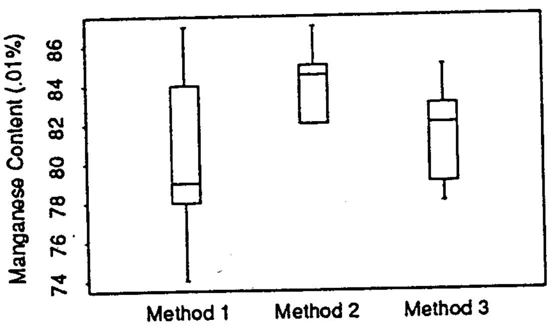
P114. 3. (a)

i	$\frac{i-.5}{10}$	$Q_1(\frac{i-.5}{10})$	$Q_2(\frac{i-.5}{10})$	$Q_3(\frac{i-.5}{10})$
1	.05	74	82	78
2	.15	77	82	79
3	.25	78	82	79
4	.35	78	84	81
5	.45	78	84	82
6	.55	80	85	82
7	.65	81	85	82
8	.75	84	85	83
9	.85	85	86	84
10	.95	87	87	85

	Q_1	*Median*	Q_3
Method 1	78	$\frac{78+80}{2} = 79$	84
Method 2	82	$\frac{84+85}{2} = 84.5$	85
Method 3	79	82	83



(b) Method 2 is the most precise, since it produces the least amount of spread. Method 3 is more precise than Method 1. Method 1 is the most accurate, since it comes closest to 80 on the average. Method 3 is more accurate than Method 2.

(c) These would be paired data. 10 specimens, 20 measurements would provide a better comparison. To compare averages under this plan, you would take differences for each of the specimens and look at the average of the 10 differences. Under the other plan, you would average measurements for 10 specimens for each method, and look at the difference between the averages. There will be less variability in the average of the differences than in the difference between the averages, because of the pairing. Less variability results in a sharper comparison of the difference.

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P116. 8 (a)

i	$\frac{i-.5}{10}$	$Q_1(\frac{i-.5}{10})$	$Q_2(\frac{i-.5}{10})$	$Q_{SN}(\frac{i-.5}{10})$
1	.05	3.03	3.19	-1.64
2	.15	5.53	4.26	-1.04
3	.25	5.60	4.47	-.67
4	.35	9.30	4.53	-.39
5	.45	9.92	4.67	-.13
6	.55	12.51	4.69	.13
7	.65	12.95	5.78	.39
8	.75	15.21	6.79	.67
9	.85	16.04	9.37	1.04
10	.95	16.84	12.75	1.64

— $Q(.84) = (.9)(16.04) + (.1)(15.21) = 15.957.$

(b) (3.03, −~~1.64~~ −1.65), (5.53, −1.04).

(c) Decimal point is at the colon
Units are millions of cycles

```
              0 :  3 : 2
                :  4 : 35577
             56 :  5 : 8
                :  6 : 8
                :  7 :
                :  8 :
Compound 1   39 :  9 : 4          Compound 2
                : 10 :
                : 11 :
             59 : 12 : 7
                : 13 :
                : 14 :
              2 : 15 :
             08 : 16 :
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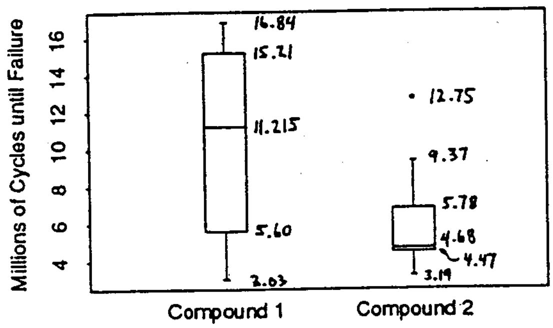
(d) $Median_1 = \frac{9.92+12.51}{2} = 11.215$, $Median_2 = \frac{4.67+4.69}{2} = 4.68$.



$Q_2(.75) = 6.79 \neq 5.78$

(e) $\bar{x}_1 = 10.693$, $s_1 = 4.819$, $\bar{x}_2 = 6.05$, $s_2 = 2.915$.

(f) The lifetimes of bearings made with Compound 1 are generally longer than those made with Compound 2, but there is more variability in the lifetimes of bearings made with Compound 1 than in the lifetimes of those made with Compound 2.

P119.17 (a)

i	$\frac{i-.5}{13}$	$Q_A(\frac{i-.5}{13})$
1	.04	79.97
2	.12	79.98
3	.19	80.00
4	.27	80.02
5	.35	80.02
6	.42	80.02
7	.50	80.03
8	.58	80.03
9	.65	80.03
10	.73	80.04
11	.81	80.04
12	.88	80.04
13	.96	80.05

i	$\frac{i-.5}{8}$	$Q_B(\frac{i-.5}{8})$
1	.06	79.94
2	.19	79.95
3	.31	79.97
4	.44	79.97
5	.56	79.97
6	.69	79.98
7	.81	80.02
8	.94	80.03

For Method A:

$Median = 80.03$

$Q_1 = (\frac{6}{8})(80.02) + (\frac{2}{8})(80.00) = 80.015$

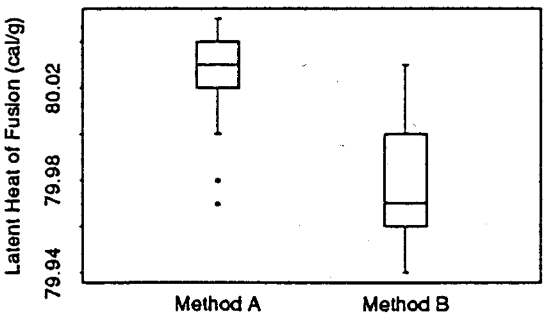
$Q_3 = 80.04$

For Method B:

$Median = 79.97$

$Q_1 = \frac{79.95+79.97}{2} = 79.96$

$Q_3 = \frac{79.98+80.02}{2} = 80.00.$



There does not seem to be any important difference in the precisions of the two methods, but Method A generally produced larger values than Method B. Since there is some fixed, true, theoretical latent heat for the fusion of ice, at least one of the methods must be somewhat inaccurate.

(b) $\bar{x}_A = 80.021$, $s_A = .024$, $\bar{x}_B = 79.979$, $s_B = .031$. The sample standard deviations are similar, as reflected by the similar magnitudes of spread in the boxplots. $\bar{x}_A > \bar{x}_B$, as reflected by the location of the boxes on the boxplot.