Math 308 Assignment 4
Exercises 2.8

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$\overline{x} = 6.5$
$m = 5.5$
$\tilde{x} = 2.389726$
$\tilde{m} = 2.342779$
$f(\overline{x}) \neq \tilde{x}$
$f(m) \neq \tilde{m}$

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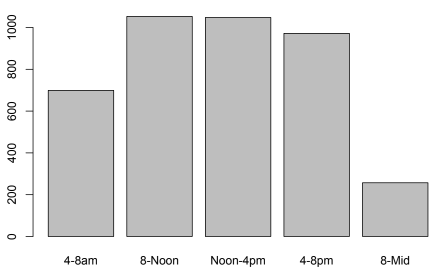
a)

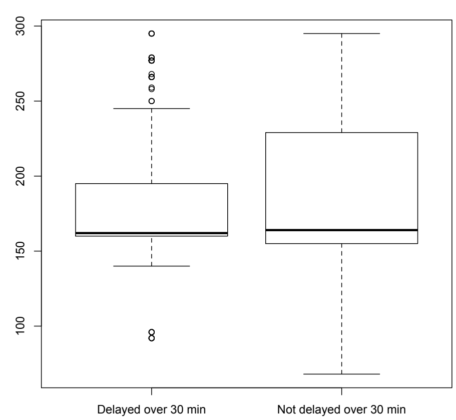
4-8am	8-Noon	Noon-4pm	4-8pm	8-Mid
699	1053	1048	972	257



b)

	No	Yes	Proportion
Mon	569	61	0.09682540
Tue	535	93	0.14808917
Wed	488	76	0.13475177
Thu	434	132	0.23321555
Fri	493	144	0.22605965
Sat	406	47	0.10375276
Sun	507	44	0.07985481

c)



d)

There appears to be no relationship.

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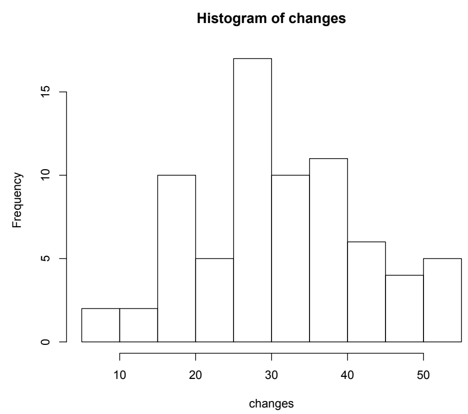
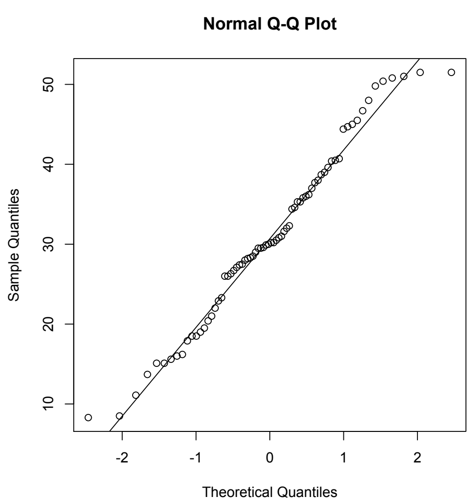
a)

Min.	1st Qu.	Median	Mean	3rd Qu.	Max.
8.30	23.20	30.10	30.93	38.17	51.50

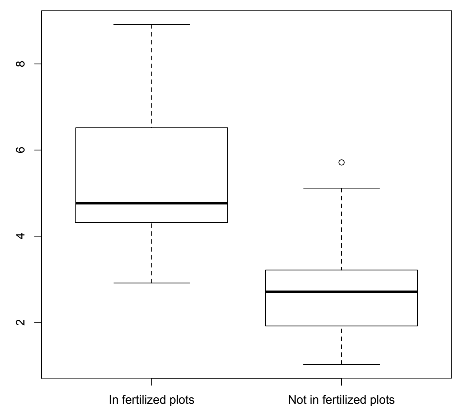
b)





The distribution is approximately normal as shown by the close fit between the normal and theoretical quantiles.

c)



d)

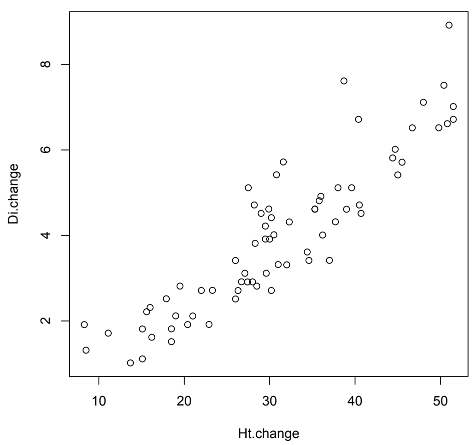
Min.	1st Qu.	Median	Mean	3rd Qu.	Max.
2.912	4.318	4.762	5.274	6.518	8.919

Table 1: Summary of F

Min.	1st Qu.	Median	Mean	3rd Qu.	Max.
1.019	1.915	2.712	2.718	3.165	5.712

Table 2: Summary of NF

e)



The diameter changes roughly increase with the height changes.

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a)

To find the median, we need a value m such that, for $a = 1/2$:

$$
\begin{aligned}
a &= \int_{-\infty}^{m} f(x)\,\mathrm{d}x \\
&= \int_{0}^{m} \lambda e^{-\lambda x}\,\mathrm{d}x \\
&= 1 - e^{-\lambda m} \\
\implies e^{-\lambda m} &= 1 - a \\
\implies -\lambda m &= \log(1-a) \\
\implies m &= \lambda^{-1} \log \frac{1}{1-a} \\
&= \lambda^{-1} \log 2
\end{aligned}
$$

Similarly, for first and third quartiles, we use $a = 1/4$, and $a = 3/4$, respectively:

$$
\begin{aligned}
Q_1 &= \lambda^{-1} \log \frac{1}{1-\frac{1}{4}} = \lambda^{-1} \log \frac{4}{3} \\
Q_2 &= \lambda^{-1} \log \frac{1}{1-\frac{3}{4}} = \lambda^{-1} \log 4
\end{aligned}
$$

b)

As with the previous problem:

$$
\begin{aligned}
a &= \int_{-\infty}^{m} f(x)\,\mathrm{d}x \\
&= \int_{1}^{m} \frac{\alpha}{x^{\alpha+1}}\,\mathrm{d}x \\
&= 1 - m^{-\alpha} \\
\implies m &= \sqrt[\alpha]{\frac{1}{1-a}} \\
&= \sqrt[\alpha]{2} \\
Q_1 &= \sqrt[\alpha]{\frac{4}{3}} \\
Q_3 &= \sqrt[\alpha]{4}
\end{aligned}
$$

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The pmf is $f(x) = \binom{20}{x} 0.3^x 0.7^{20-x}$. So, the cdf $F(x) = \sum_{i=0}^{x} f(i)$. Then, there is no such q, since 2 is too small ($F(2) < 0.04$) and 3 is too large ($F(3) > 0.1$).

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a)

One the QQ plot, the points showed a close fit to the straight line, but the histogram was never symmetric, only sometimes unimodal, and rarely mound-shaped.

b)

While the quality of the fit stayed good, the histograms only had a marginal improvement in terms of resembling a normal distribution (symmetric, unimodal and mound-shaped).

c)

It seems that QQ-normal plots are better for visually determining whether or not data is normally distributed.

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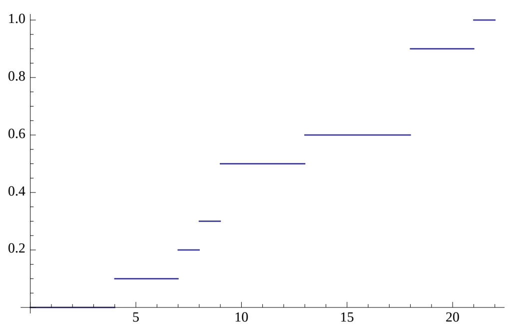
x	f	cf	cdf=cf/total
4	1	1	0.1
7	1	2	0.2
8	1	3	0.3
9	2	5	0.5
13	1	6	0.6
18	3	9	0.9
21	1	10	1.0



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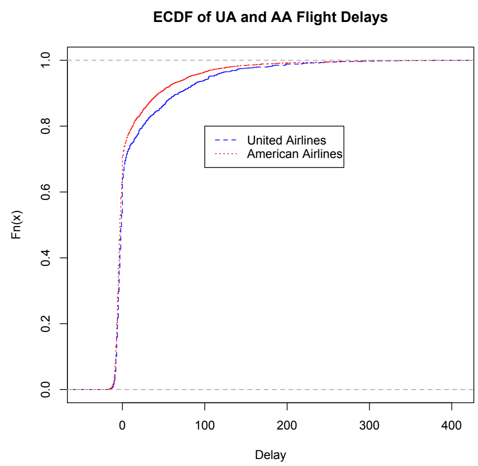

From the plot, we can see that for a small range of delay times, the ecdf is higher for AA than for UA.