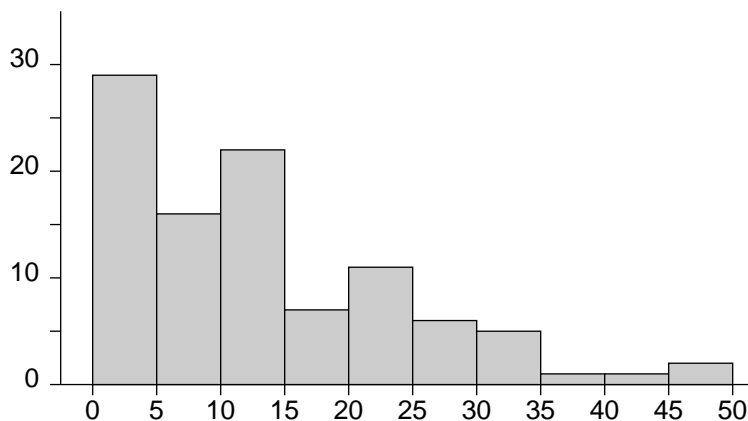


(38, 61, 78, 83, 94),  $\bar{x} = 72.3$ .

1. (10 pts) (0, 6, 7, 10, 10),  $\bar{x} = 7.1$ .

There are many choices for the classes. One easy choice is 0-4, 5-9, 10-14, 15-19, etc., with frequencies 29, 16, 22, 7, etc. That will produce the following histogram:

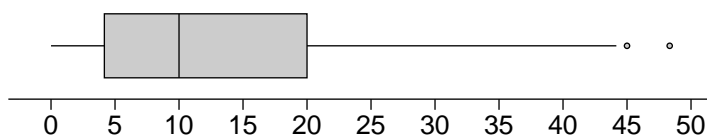


2. (18 pts) (0, 14, 15, 17, 18),  $\bar{x} = 14.1$ .

- (a) (6 pts) Because there are 100 numbers, the median will be the average of the 50th and 51st numbers. That average is 10. There are 50 numbers in the first half, so the first quartile is the average of the 25th and 26th numbers. That is 4. Similarly, the third quartile is the average of the 75th and 76th numbers, which is 20. So the five-number summary is 0, 4, 10, 20, 48.

You could also get this by entering all 100 numbers into list  $L_1$  on the TI-83 and pressing **STAT**, then **CALC**, then **1-Var Stats  $L_1$** . Scroll to the bottom and see the five-number summary.

- (b) (6 pts) The modified boxplot must show outliers, if there are any. Compute the  $IQR = 20 - 4 = 16$ . Then compute  $STEP = 1.5 \times IQR = 24$ . Subtract this from  $Q_1$  to get  $-20$  and add it to  $Q_3$  to get 44. Any values outside the range  $-20$  to 44 are considered outliers. Thus, 45 and 48 are outliers. They should be plotted as separate dots.



- (c) (3 pts) From the original stem-and-leaf display, this histogram, and the boxplot, it is clear that the distribution is skewed right. At the same time, the stem-and-leaf display shows a unimodal distribution while that is not so clear in the histogram.
- (d) (3 pts) If Senator Byrd were replaced by a new senator, that would reduce the standard deviation because the new senator's tenure would be much closer to the mean.
3. (16 pts) (2, 8, 13, 15.5, 16),  $\bar{x} = 11.5$ .

- (a) (4 pts) Enter the data as list  $L_1$  into the TI-83. The press **STAT**, **CALC**, **1-Var Stats**  $L_1$ . The display shows that  $\bar{x} = 16521$ .
- (b) (4 pts) The same display as in part (a) shows that  $s = 12579$ .
- (c) (4 pts) Use the mean and standard deviation to find the  $z$ -score of 8000:

$$z = \frac{8000 - 16521}{12579} = -0.6774.$$

- (d) (4 pts) The quickest way to show that there are no outliers is to find the  $z$ -scores of the largest and the smallest values. They are

$$z = \frac{1500 - 16521}{12579} = -1.194$$

and

$$z = \frac{36400 - 16521}{12579} = 1.580.$$

These are the extremes and neither is beyond 2.5 or  $-2.5$ . Therefore, there are no outliers.

4. (8 pts) (0, 7, 8, 8, 8),  $\bar{x} = 6.8$ .

- (a) (4 pts)  $P(-2.45 < Z < 1.32) = \text{normalcdf}(-2.45, 1.32) = 0.8994$ .
- (b) (4 pts) The 45th percentile is  $\text{invNorm}(.45) = -0.1257$ .

5. (16 pts) (0, 12, 16, 16, 16),  $\bar{x} = 12.9$ .

- (a) (4 pts) The proportion between 90 and 120 is  $\text{normalcdf}(90, 120, 100, 15) = 0.6563$ .
- (b) (4 pts) The proportion greater than 120 is  $\text{normalcdf}(120, E99, 100, 15) = 0.09121$ .
- (c) (4 pts) The first quartile of IQ scores is  $\text{invNorm}(.25, 100, 15) = 89.88$ .
- (d) (4 pts) The value that cuts off the top 5% also cuts off the lower 95%, so it is the 95th percentile. That is  $\text{invNorm}(.95, 100, 15) = 124.7$ .

6. (8 pts)  $(0, 2, 2, 6.5, 8)$ ,  $\bar{x} = 3.9$ .

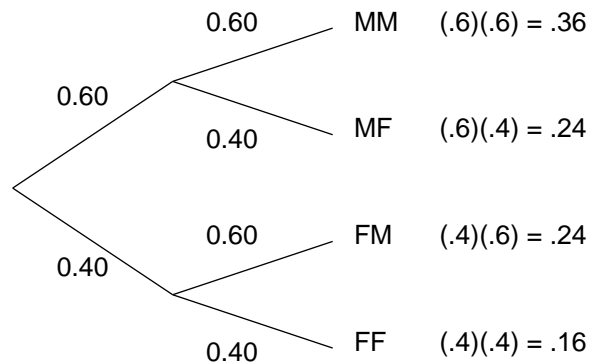
- (a) (2 pts) The base is 8 and the area is 1 and  $A = \frac{1}{2}bh$ . So  $1 = \frac{1}{2}(8)h = 4h$ . That means that  $h = \frac{1}{4}$ .
- (b) (6 pts) The height of the triangle at 2 is  $(\frac{3}{4})(\frac{1}{4}) = \frac{3}{16}$  and the height at 4 is  $(\frac{1}{2})(\frac{1}{4}) = \frac{1}{8}$ . The triangle from 2 to 8 has area  $(\frac{1}{2})(\frac{3}{16})(6) = \frac{9}{16}$  and the triangle from 4 to 8 has area  $(\frac{1}{2})(\frac{1}{8})(4) = \frac{1}{4}$ . The probability is the difference  $\frac{9}{16} - \frac{1}{4} = \frac{5}{16} = 0.3125$ .

7. (12 pts)  $(0, 5, 10, 12, 12)$ ,  $\bar{x} = 8.2$ .

- (a) (4 pts) The direction of extreme is to the right. Therefore,  $\alpha$  is the area under  $N(20, 5)$  to the right of 25. That is,  $\alpha = \text{normalcdf}(25, E99, 20, 5) = 0.1587$ .
- (b) (4 pts)  $\beta$  is the area to the left of 25 under  $N(30, 10)$ . That is,  $\beta = \text{normalcdf}(-E99, 25, 30, 10) = 0.3085$ .
- (c) (4 pts) The  $p$ -value is similar to  $\alpha$ . Find the area to the right of 30 under  $N(20, 5)$ . It is  $\text{normalcdf}(30, E99, 20, 5) = 0.02275$ .

8. (12 pts)  $(0, 7, 9, 10.5, 12)$ ,  $\bar{x} = 7.7$ .

- (a) (9 pts) To find the sampling distribution  $\hat{p}$  when  $n = 2$ , draw a tree diagram two levels deep:



The two middle cases lead to the same sample proportion,  $\frac{1}{2}$ , so they should be combined in the table.

$\hat{p}$	$P(\hat{p})$
0	0.16
$\frac{1}{2}$	0.48
1	0.36

- (b) (3 pts) From the table, we see that the probability that  $\hat{p} = \frac{1}{2}$  is 0.48.