Discrete Mathematics

Section 8: Statistics

Note: In this section, all numerical values have been rounded for ease of presentation. As a result, you may observe slight discrepancies between your calculated results and the values provided in this document. These differences are acceptable, as the focus is on understanding the underlying concepts and methods rather than on exact numerical precision. Furthermore, outliers have been identified through visual inspection rather than by applying formal mathematical criteria or statistical methods.

Questions

1. Determine the population variance and identify any outliers in the data set: 5, 10, 15, 20, 150.
2. Find the median, mode, and range of the data set: 10, 15, 15, 20, 25, 30, 30.
3. Calculate the mean, sample variance, and standard deviation for these numbers: 2, 4, 4, 6, 8, 10.
4. Identify any outliers and then calculate the population variance of the data set: 100, 105, 110, 115, 500.
5. Determine the population variance and identify any outliers in the data set: 7, 14, 21, 28, 35, 100.
6. Find the median, mode, and range of the data set: 5, 10, 10, 15, 20, 25, 25.
7. Calculate the mean, sample variance, and standard deviation for these numbers: 6, 9, 12, 15, 18, 21.
8. Identify any outliers and then calculate the population variance of the data set: 50, 55, 60, 65, 200.
9. Determine the population variance in the data set: 12, 24, 36, 48, 100.
10. Find the median, mode, and range of the data set: 8, 16, 16, 24, 32, 40.
11. Calculate the mean, sample variance, and standard deviation for these numbers: 10, 15, 15, 20, 25, 30.
12. Identify any outliers and then calculate the population variance of the data set: 200, 205, 210, 215, 1000.
13. Determine the population variance and identify any outliers in the data set: 3, 6, 9, 12, 50.
14. Find the median, mode, and range of the data set: 7, 14, 14, 21, 28, 35.
15. Calculate the mean, sample variance, and standard deviation for these numbers: 4, 8, 8, 12, 16, 20.
16. Identify any outliers and then calculate the population variance of the data set: 15, 30, 45, 60, 300.
17. Determine the population variance and identify any outliers in the data set: 9, 18, 27, 36, 100.
18. Find the median, mode, and range of the data set: 5, 10, 15, 15, 20, 25.
19. Calculate the mean, sample variance, and standard deviation for these numbers: 3, 6, 9, 12, 15, 18.
20. Identify any outliers and then calculate the population variance of the data set: 30, 35, 40, 45, 200.
21. Determine the population variance for the following data set: 14, 28, 42, 56, 100.

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22. Find the median, mode, and range of the data set: 9, 18, 18, 27, 36, 45.

23. Calculate the mean, sample variance, and standard deviation for these numbers: 5, 10, 10, 15, 20, 25.

24. Identify any outliers and then calculate the population variance of the data set: 100, 110, 120, 130, 500.

25. Determine the population variance and identify any outliers in the data set: 4, 8, 12, 16, 50.

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Questions and Answers

1. Determine the population variance and identify any outliers in the data set: 5, 10, 15, 20, 150.
   First, identify the outlier, which is 150, as it is significantly larger than the rest of the data set. Next, calculate the mean:
   $$\text{Mean} = \frac{5+10+15+20+150}{5} = \frac{200}{5} = 40$$
   Now, calculate the population variance:
   $$\sigma^2 = \frac{(5-40)^2+(10-40)^2+(15-40)^2+(20-40)^2+(150-40)^2}{5}$$
   $$= \frac{1,225+900+625+400+12,100}{5} = \frac{15,250}{5} = 3,050$$
   Thus, the population variance is 3,050.

2. Find the median, mode, and range of the data set: 10, 15, 15, 20, 25, 30, 30.
   Since the data set has 7 numbers, the median is the 4th number, which is 20. The modes are 15 and 30 (both occur twice), and the range is 30 - 10 = 20.

3. Calculate the mean, sample variance, and standard deviation for these numbers: 2, 4, 4, 6, 8, 10.
   Calculate the mean:
   $$\text{Mean} = \frac{2+4+4+6+8+10}{6} = \frac{34}{6} \approx 5.67$$
   Calculate the sample variance:
   $$s^2 = \frac{(2-5.67)^2+(4-5.67)^2+(4-5.67)^2+(6-5.67)^2+(8-5.67)^2+(10-5.67)^2}{5}$$
   $$= \frac{13.49+2.79+2.79+0.11+5.43+18.75}{5} = \frac{43.36}{5} \approx 8.67$$
   Calculate the standard deviation:
   $$s = \sqrt{8.67} \approx 2.94$$

4. Identify any outliers and then calculate the population variance of the data set: 100, 105, 110, 115, 500.
   First, identify the outlier which is 500.
   Calculate the mean:
   $$\text{Mean} = \frac{100+105+110+115+500}{5} = \frac{930}{5} = 186$$
   Calculate the population variance:
   $$\sigma^2 = \frac{(100-186)^2+(105-186)^2+(110-186)^2+(115-186)^2+(500-186)^2}{5}$$
   $$= \frac{7,396+6,561+5,776+5,041+98,596}{5} = \frac{123,370}{5} = 24,674$$

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5. Determine the population variance and identify any outliers in the data set: 7, 14, 21, 28, 35, 100.
First, identify the outlier which is 100.
Calculate the mean:
$$\text{Mean} = \frac{7+14+21+28+35+100}{6} = \frac{205}{6} \approx 34.17$$
Calculate the population variance:
$$\sigma^2 = \frac{(7-34.17)^2 + (14-34.17)^2 + (21-34.17)^2 + (28-34.17)^2 + (35-34.17)^2 + (100-34.17)^2}{6}$$
$$= \frac{738.21 + 406.83 + 173.45 + 38.06 + 0.69 + 4,333.59}{6} = \frac{5,690.83}{6} \approx 948.47$$
The standard deviation is:
$$\sigma = \sqrt{948.47} \approx 30.8$$

6. Find the median, mode, and range of the data set: 5, 10, 10, 15, 20, 25, 25.
Since the dataset has 7 numbers, the median is the 4th number, which is 15. The modes are 10 and 25 since they appear twice, and the range is 25 - 5 = 20.

7. Calculate the mean, sample variance, and standard deviation for these numbers: 6, 9, 12, 15, 18, 21.
Calculate the mean:
$$\text{Mean} = \frac{6+9+12+15+18+21}{6} = \frac{81}{6} = 13.5$$
Calculate the sample variance:
$$s^2 = \frac{(6-13.5)^2 + (9-13.5)^2 + (12-13.5)^2 + (15-13.5)^2 + (18-13.5)^2 + (21-13.5)^2}{5}$$
$$= \frac{56.25 + 20.25 + 2.25 + 2.25 + 20.25 + 56.25}{5} = \frac{157.5}{5} = 31.5$$
Calculate the standard deviation:
$$s = \sqrt{31.5} \approx 5.61$$

8. Identify any outliers and then calculate the population variance of the data set: 50, 55, 60, 65, 200.
First, identify the outlier which is 200.
Calculate the mean:
$$\text{Mean} = \frac{50+55+60+65+200}{5} = \frac{430}{5} = 86$$
Calculate the population variance:
$$\sigma^2 = \frac{(50-86)^2 + (55-86)^2 + (60-86)^2 + (65-86)^2 + (200-86)^2}{5}$$
$$= \frac{1,296 + 961 + 676 + 441 + 12,996}{5} = \frac{16,370}{5} = 3,274$$

9. Determine the population variance in the data set: 12, 24, 36, 48, 100.
Calculate the mean:
$$\text{Mean} = \frac{12+24+36+48+100}{5} = \frac{220}{5} = 44$$
Calculate the population variance:
$$\sigma^2 = \frac{(12-44)^2 + (24-44)^2 + (36-44)^2 + (48-44)^2 + (100-44)^2}{5}$$
$$= \frac{1,024 + 400 + 64 + 16 + 3,136}{5} = \frac{4,640}{5} = 928$$

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10. Find the median, mode, and range of the data set: 8, 16, 16, 24, 32, 40.
Since the dataset has 6 numbers, the median is the average of the 3rd and 4th numbers, which is:

$$\frac{16+24}{2} = 20$$

The mode is 16 since it appears twice, and the range is 40 - 8 = 32.

11. Calculate the mean, sample variance, and standard deviation for these numbers: 10, 15, 15, 20, 25, 30.
Calculate the mean:

$$\text{Mean} = \frac{10+15+15+20+25+30}{6} = \frac{115}{6} \approx 19.17$$

Calculate the sample variance:

$$s^2 = \frac{(10-19.17)^2 + (15-19.17)^2 + (15-19.17)^2 + (20-19.17)^2 + (25-19.17)^2 + (30-19.17)^2}{5}$$

$$= \frac{84.09 + 17.39 + 17.39 + 0.69 + 33.99 + 117.29}{5} = \frac{270.84}{5} \approx 54.17$$

Calculate the standard deviation:

$$s = \sqrt{54.17} \approx 7.36$$

12. Identify any outliers and then calculate the population variance of the data set: 200, 205, 210, 215, 1000.
First, identify the outlier which is 1000.
Calculate the mean:

$$\text{Mean} = \frac{200+205+210+215+1000}{5} = \frac{1,830}{5} = 366$$

Calculate the population variance:

$$\sigma^2 = \frac{(200-366)^2 + (205-366)^2 + (210-366)^2 + (215-366)^2 + (1000-366)^2}{5}$$

$$= \frac{27,556 + 25,921 + 24,336 + 22,801 + 401,956}{5} = \frac{502,570}{5} = 100,514$$

13. Determine the population variance and identify any outliers in the data set: 3, 6, 9, 12, 50.
First, identify the outlier which is 50.
Calculate the mean:

$$\text{Mean} = \frac{3+6+9+12+50}{5} = \frac{80}{5} = 16$$

Calculate the population variance:

$$\sigma^2 = \frac{(3-16)^2 + (6-16)^2 + (9-16)^2 + (12-16)^2 + (50-16)^2}{5}$$

$$= \frac{169 + 100 + 49 + 16 + 1,156}{5} = \frac{1,490}{5} = 298$$

14. Find the median, mode, and range of the data set: 7, 14, 14, 21, 28, 35.
Since the dataset has 6 numbers, the median is the average of the 3rd and 4th numbers, which is:

$$\frac{14+21}{2} = 17.5$$

The mode is 14 since it appears twice, and the range is 35 - 7 = 28.

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15. Calculate the mean, sample variance, and standard deviation for these numbers: 4, 8, 8, 12, 16, 20.
Calculate the mean:
$$\text{Mean} = \frac{4+8+8+12+16+20}{6} = \frac{68}{6} \approx 11.33$$
Calculate the sample variance:
$$s^2 = \frac{(4-11.33)^2 + (8-11.33)^2 + (8-11.33)^2 + (12-11.33)^2 + (16-11.33)^2 + (20-11.33)^2}{5}$$
$$= \frac{53.77 + 11.09 + 11.09 + 0.45 + 21.79 + 75.18}{5} = \frac{173.37}{5} \approx 34.67$$
Calculate the standard deviation:
$$s = \sqrt{34.67} \approx 5.89$$

16. Identify any outliers and then calculate the population variance of the data set: 15, 30, 45, 60, 300.
First, identify the outlier which is 300.
Calculate the mean:
$$\text{Mean} = \frac{15+30+45+60+300}{5} = \frac{450}{5} = 90$$
Calculate the population variance:
$$\sigma^2 = \frac{(15-90)^2 + (30-90)^2 + (45-90)^2 + (60-90)^2 + (300-90)^2}{5}$$
$$= \frac{5,625 + 3,600 + 2,025 + 900 + 44,100}{5} = \frac{56,250}{5} = 11,250$$

17. Determine the population variance and identify any outliers in the data set: 9, 18, 27, 36, 100.
First, identify the outlier which is 100.
Calculate the mean:
$$\text{Mean} = \frac{9+18+27+36+100}{5} = \frac{190}{5} = 38$$
Calculate the population variance:
$$\sigma^2 = \frac{(9-38)^2 + (18-38)^2 + (27-38)^2 + (36-38)^2 + (100-38)^2}{5}$$
$$= \frac{841 + 400 + 121 + 4 + 3,844}{5} = \frac{5,210}{5} = 1,042$$

18. Find the median, mode, and range of the data set: 5, 10, 15, 15, 20, 25.
Since the dataset has 6 numbers, the median is the average of the 3rd and 4th numbers, which is:
$$\frac{15+15}{2} = 15$$
The mode is 15 since it appears twice. The range is calculated as 25 - 5 = 20

19. Calculate the mean, sample variance, and standard deviation for these numbers: 3, 6, 9, 12, 15, 18.
Calculate the mean:
$$\text{Mean} = \frac{3+6+9+12+15+18}{6} = \frac{63}{6} = 10.5$$
Calculate the sample variance:
$$s^2 = \frac{(3-10.5)^2 + (6-10.5)^2 + (9-10.5)^2 + (12-10.5)^2 + (15-10.5)^2 + (18-10.5)^2}{5}$$
$$= \frac{56.25 + 20.25 + 2.25 + 2.25 + 20.25 + 56.25}{5} = \frac{157.5}{5} = 31.5$$
Calculate the standard deviation:
$$s = \sqrt{31.5} \approx 5.61$$

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20. Identify any outliers and then calculate the population variance of the data set: 30, 35, 40, 45, 200.
First, identify the outlier which is 200.
Calculate the mean:
$$\text{Mean} = \frac{30+35+40+45+200}{5} = \frac{350}{5} = 70$$
Calculate the population variance:
$$\sigma^2 = \frac{(30-70)^2+(35-70)^2+(40-70)^2+(45-70)^2+(200-70)^2}{5}$$
$$= \frac{1,600+1,225+900+625+16,900}{5} = \frac{21,250}{5} = 4,250$$

21. Determine the population variance for the following data set: 14, 28, 42, 56, 100.
First, calculate the mean:
$$\text{Mean} = \frac{14+28+42+56+100}{5} = \frac{240}{5} = 48$$
Calculate the population variance:
$$\sigma^2 = \frac{(14-48)^2+(28-48)^2+(42-48)^2+(56-48)^2+(100-48)^2}{5}$$
$$= \frac{1,156+400+36+64+2,704}{5} = \frac{4,360}{5} = 872$$

22. Find the median, mode, and range of the data set: 9, 18, 18, 27, 36, 45.
Since the dataset has 6 numbers, the median is the average of the 3rd and 4th numbers, which is:
$$\frac{18+27}{2} = 22.5$$
The mode is 18 since it appears twice, and the range is 45 - 9 = 36.

23. Calculate the mean, sample variance, and standard deviation for these numbers: 5, 10, 10, 15, 20, 25.
Calculate the mean:
$$\text{Mean} = \frac{5+10+10+15+20+25}{6} = \frac{85}{6} \approx 14.17$$
Calculate the sample variance:
$$s^2 = \frac{(5-14.17)^2+(10-14.17)^2+(10-14.17)^2+(15-14.17)^2+(20-14.17)^2+(25-14.17)^2}{5}$$
$$= \frac{84.10+17.38+17.38+0.69+34.00+117.28}{5} = \frac{270.83}{5} \approx 54.17$$
Calculate the standard deviation:
$$s = \sqrt{54.17} \approx 7.36$$

24. Identify any outliers and then calculate the population variance of the data set: 100, 110, 120, 130, 500.
First, identify the outlier which is 500.
Calculate the mean:
$$\text{Mean} = \frac{100+110+120+130+500}{5} = \frac{960}{5} = 192$$
Calculate the population variance:
$$\sigma^2 = \frac{(100-192)^2+(110-192)^2+(120-192)^2+(130-192)^2+(500-192)^2}{5}$$
$$= \frac{8,464+6,724+5,184+3,844+94,864}{5} = \frac{119,080}{5} = 23,816$$

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25. Determine the population variance and identify any outliers in the data set: 4, 8, 12, 16, 50.
First, identify the outlier which is 50.
Calculate the mean:

$$\text{Mean} = \frac{4+8+12+16+50}{5} = \frac{90}{5} = 18$$

Calculate the population variance:

$$\sigma^2 = \frac{(4-18)^2 + (8-18)^2 + (12-18)^2 + (16-18)^2 + (50-18)^2}{5}$$

$$= \frac{196 + 100 + 36 + 4 + 1,024}{5} = \frac{1,360}{5} = 272$$

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