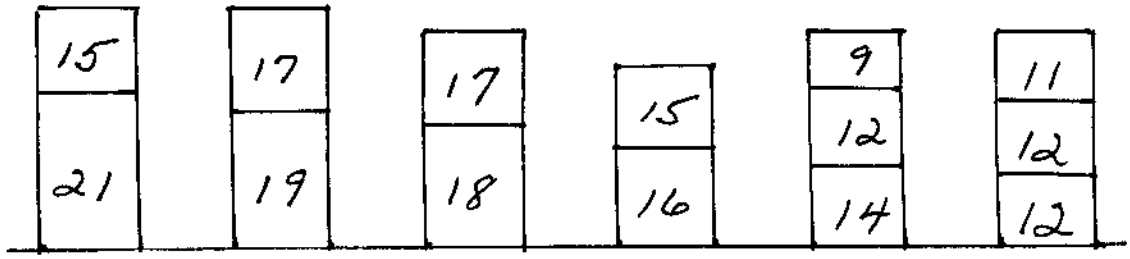
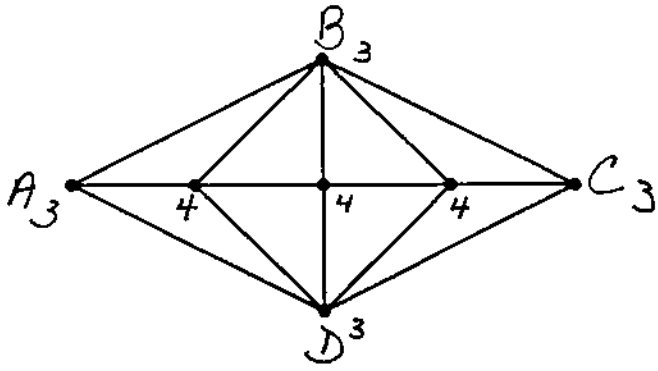
1. Decreasing order: 21, 19, 18, 17, 17, 16, 15, 15, 14, 12, 12, 12, 11, 9.



Six bins are necessary.

2. Applying the nearest-neighbor algorithm for the traveling salesman problem is useful in solving this problem.

3. The valences for the vertices are noted.



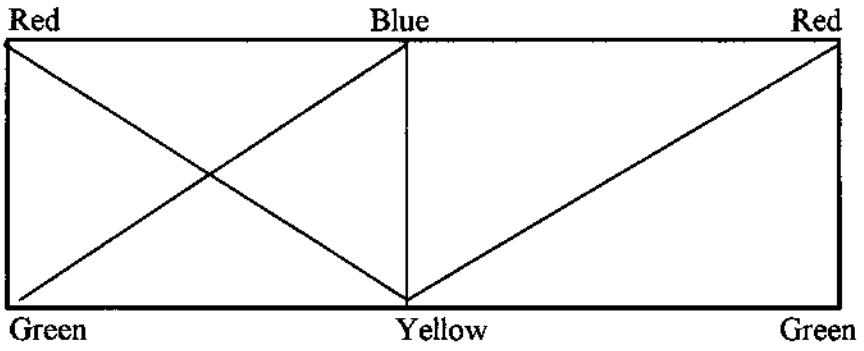
By removing the edges AB and CD, all valences will be made even. Therefore, the graph will have an Euler circuit.

4. The indicated path starts at vertex E, covers each edge exactly once, and ends at vertex D. Therefore, the sequence of numbered edges traverses each edge exactly once, but it is not an Euler circuit.

5. Number of lottery combinations = 49 x 48 x 47 x 46 x 45 x 42

= 9, 610, 695, 360

6.



The chromatic number is 4.

7. I. False. The control group received the placebo.

II. True.

III. True.

8. Find the class mark for each class of data: 22, 31, 40, 49, 58, 67.

Enter the class marks in L_1 and the number of people in L_2.

Choose 1-Var Stats L_1, L_2 from the CALC menu.
$\bar{x} = 43.8$
$s = 14.17$

9. I. False. The mean is not one of the numbers in a five-number summary.

II. True.

III. True.

10. I. False. The population consists of all the Congresswoman's constituents.

II. True.

III. True. (270/450) 100 = 60%

11. Enter x-values in L_1 and y-values in L_2.
Choose Lin Reg $(ax+b)\,L_1, L_2$ from the CALC menu.
$a = .8435633126$
$b = -32.96490278$

This equation is $y = .84x - 32.96$, correct to two decimal places.

12. There are 19 pieces of data represented by this histogram. The position of the median is $\frac{n+1}{2} = \frac{19+1}{2} = 10.$
The piece of data in the tenth position is the number 8. The mode is the most frequently occurring piece of data. The mode is 6.

13. P(3) = .24 since the sum of the probabilities must be 1.

P(at least 3 cars) = P(3) + P(4) + P(5) + P(6)

= .24 + .36 + .15 + .05

= .80

or P(at least 3 cars) = 1 - P(0) - P(1) - P(2)

= .80

14. $\mu = 3.5, \quad \sigma = 1.5$

$x = 2: \quad z = \frac{x-\mu}{\sigma} = \frac{2-3.5}{1.5} = -1$

$x = 5: \quad z = \frac{5-3.5}{1.5} = 1$

$P(2 \le x \le 5) = P(-1 \le z \le 1)$

= .68

since 68% of the data in a normal distribution is within one standard deviation of the mean.

15. Since 25% of the incomes lie below Q_1, 75% of the incomes must lie above Q_1.

$Q_1 = \mu - .67\sigma$

$Q_1 = \$41{,}500 - .67\,(\$8{,}725)$

$Q_1 = \$35{,}654.25$

16. 2.4% is one-half of 4.8%. Therefore, the sample size would have to be increased by a factor of 4: $4 \times 90 = 360$.

The new sample size would have to be 360.

17. There are 8 possible outcomes in the sample space: $(2 \times 2 \times 2)$. Of these (H, H, T), (H, T, H), and (T, H, H) are the only 3 with exactly 2 heads. P(exactly 2 heads) $= \frac{3}{8}$.

18. Target value = 12 oz.

$$\sigma_{\bar{x}} = \frac{\sigma}{\sqrt{n}} = \frac{.19oz}{\sqrt{25}}$$

95% control limits: $12 \pm 2\frac{.19}{\sqrt{25}} \longrightarrow$ 11.924 oz. and 12.076 oz.

Name:_____ Section:_____

The following questions are free response. Please show all work in order to receive credit.

19. (14 pts)

a. The list processing algorithm for scheduling tasks is guaranteed to always produce an optimal solution.

True (False)

b. Majority rule is a good way to choose between two alternatives.

(True) False

c. An observational study may be used to show cause and effect.

True (False)

d. The mean is one of the numbers in a five-number summary.

True (False)

e. A set of data must be ordered before its median is found.

(True) False

f. Every connected graph has an Euler circuit.

True (False)

g. Every graph with an Euler circuit has only vertices with even valences.

(True) False

h. The path produced by the sorted edges algorithm when solving the traveling salesman problem may be dependent on the starting city.

True (False)

i. A spanning tree of a graph must contain every edge of the graph.

True (False)

j. A digraph is a graph with exactly two edges.

True (False)

k. Every set of voters' preference lists produces a Condorcet winner.

True (False)

l. The sum of the probabilities in a probability model must be 1.

(True) False

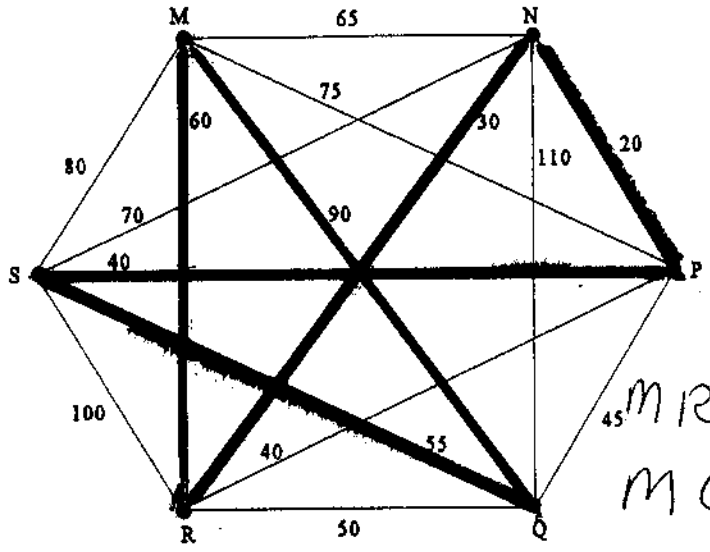
m. A control chart is a plot whose purpose is to display a five-number summary of a set of quality control data.

True (False)

n. A number that is calculated from a sample is called statistic.

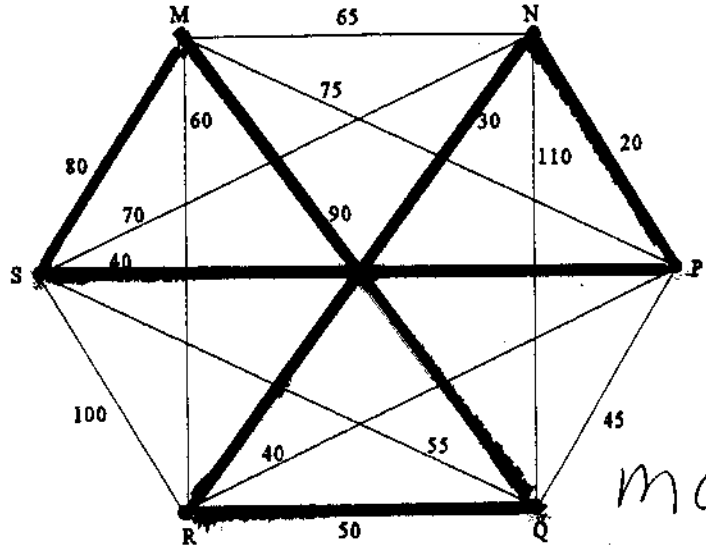
(True) False

20. a. Use the nearest-neighbor algorithm starting at vertex M to find a Hamiltonian circuit. (4pts)



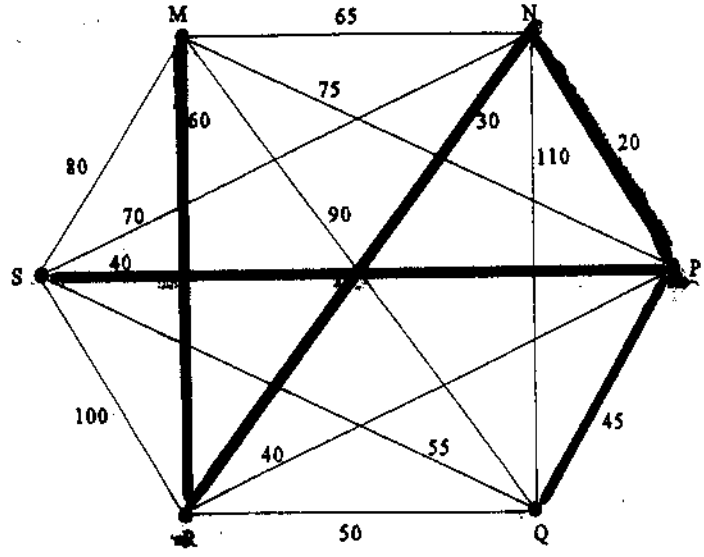
M R N P S Q M
M Q S P N R M

b. Use the sorted-edges algorithm to find a Hamiltonian circuit. (4pts)

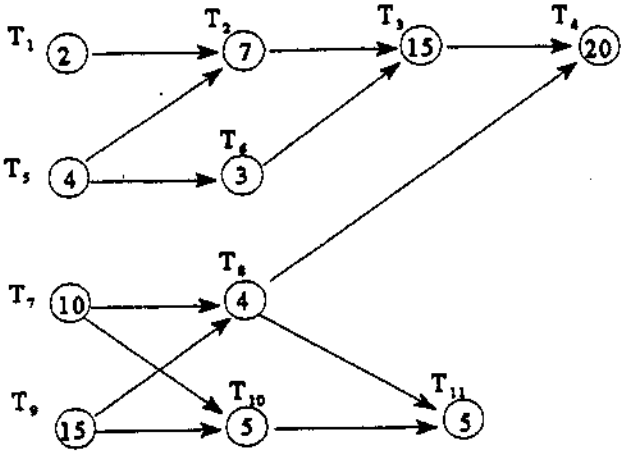


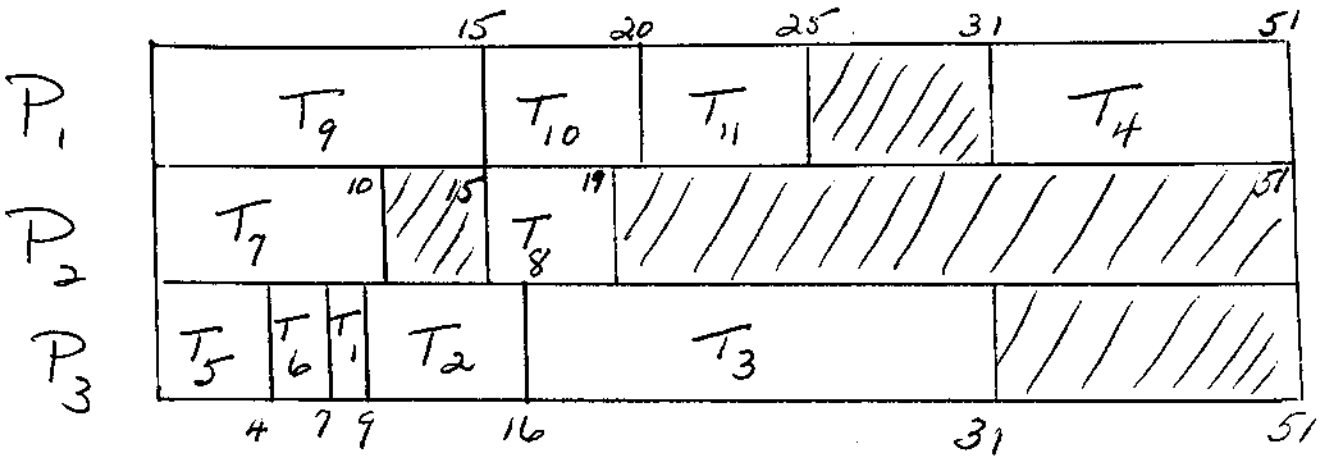
M Q R N P S M

c. Use Kruskal's algorithm to find the minimum cost spanning tree. (4pts)



21. Consider the order-requirement digraph below. Processing times are encircled. Use the list-processing algorithm with the priority list T_{10}, T_8, T_6, T_4, T_2, T_{11}, T_9, T_7, T_5, T_3, T_1 to schedule the tasks on three processors. (8pts)





22. Bhattacharyya and Layton report on the number of road accident deaths in Queensland Australia for the period 1950 – 1976 (Journal of American Statistical Association, September 1979). The deaths in the first quarter of each of these years were as follows: (8pts)

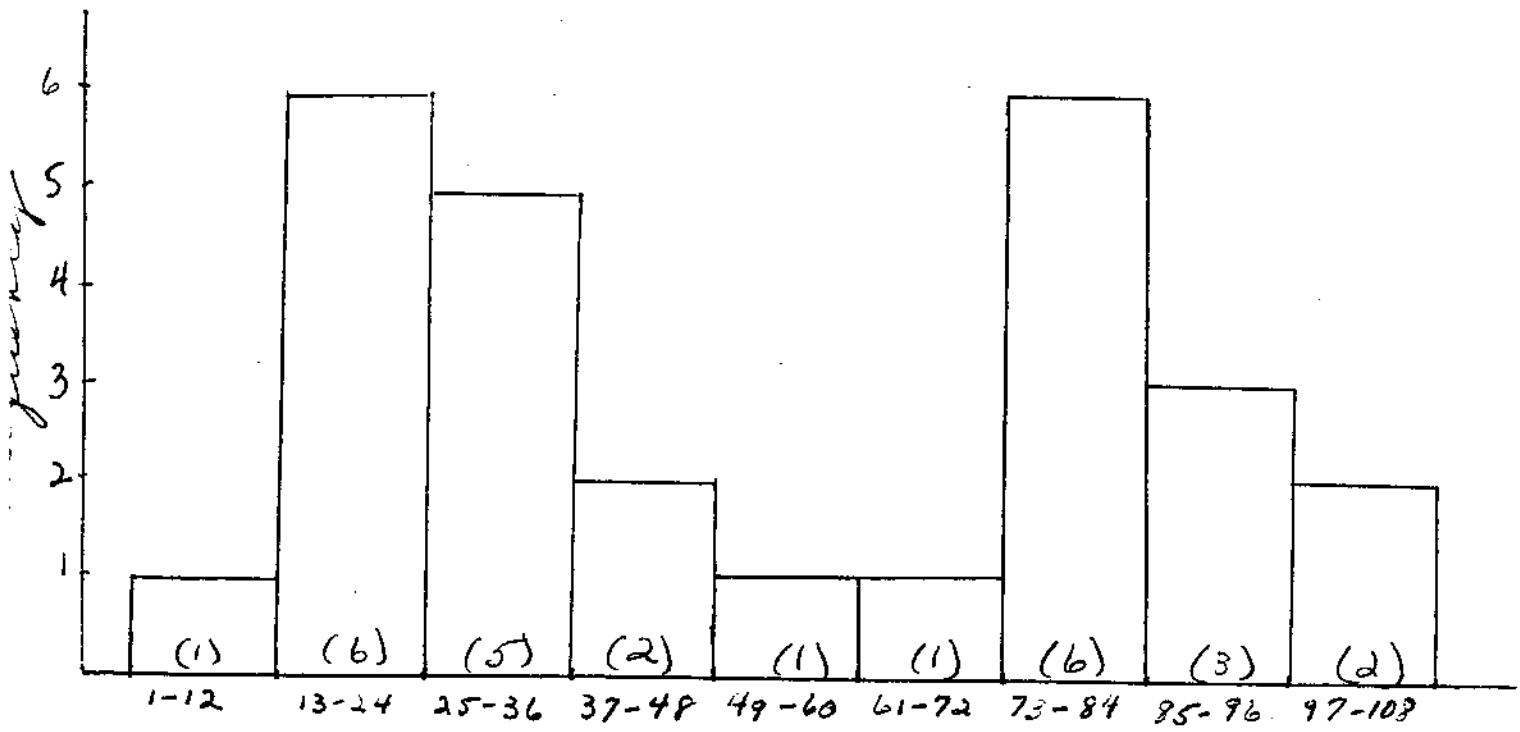
18 14 17 22 16 26 33 27 35 28 44 40 31 53 70 73 2 74 93 103
75 86 84 90 79 99 73

a. Construct a frequency distribution with classes of width 12.

One possible solution:

Classes	Tally	Frequency
1 – 12	𝍸	1
13 – 24	𝍸𝍸 𝍸	6
25 – 36	𝍸𝍸	5
37 – 48	𝍸	2
49 – 60	𝍸	1
61 – 72	𝍸	1
73 – 84	𝍸𝍸 𝍸	6
85 – 96	𝍸	3
97 – 108	𝍸	2

b. Using information from part a, construct a frequency histogram.



23. A recent Gallup Poll found that 960 of the 1500 people polled agree that guns are too accessible to teenagers. (8pts)

a. Find the percentage of those polled who feel that guns are too accessible to teenagers?

$$\hat{p} = \frac{960}{1500} = .64 = 64\%$$

b. Find the standard deviation of the sampling distribution of this statistic.
(Correct to one decimal place)

$$s_{\hat{p}} = \sqrt{\frac{\hat{p}(100-\hat{p})}{n}}$$

$$= \sqrt{\frac{64(100-64)}{1500}}$$

$$= 1.2\%$$

c. Construct a 95% confidence interval for the true proportion of those polled who feel that guns are too accessible.

$$\hat{p} \pm 2 s_{\hat{p}}$$

$$64\% \pm 2(1.2\%)$$

$$64\% \pm 2.4\% \Rightarrow 61.6\% \text{ to } 66.4\%$$

d. What is the margin of error for samples of size 1500?

margin of error is 2.4%

24. Voters are to elect one of five candidates A, B, C, D, or E. Their preference lists are shown below: (10pts)

	Number of Votes					
	18	12	10	9	4	2
First Choice	A	B	C	D	E	E
Second Choice	D	E	B	C	B	C
Third Choice	E	D	E	E	D	D
Fourth Choice	C	C	D	B	C	B
Fifth Choice	B	A	A	A	A	A

Which candidate wins using:

a. plurality? First place votes: A has 18
B has 12
C has 10
D has 9
E has 6
A wins

b. the Borda count?
A: $18 \cdot 4 = 72$
B: $12 \cdot 4 + 14 \cdot 3 + 11 \cdot 1 = 101$
C: $10 \cdot 4 + 11 \cdot 3 + 34 \cdot 1 = 107$
D: $9 \cdot 4 + 18 \cdot 3 + 18 \cdot 2 + 10 \cdot 1 = 136$
E: $6 \cdot 4 + 12 \cdot 3 + 37 \cdot 2 = 134$
D wins

c. sequential pairwise voting with agenda EABCD?
E vs A: 37 18, E wins
E vs B: 33 22, E wins
E vs C: 36 19, E wins
E vs D: 28 27, E wins
E wins

d. the Hare system?
Round 1: E is eliminated
Round 2: D is eliminated
Round 3: B is eliminated
Round 4: C wins by majority: 37 to 18
C wins