1. I. False. Every graph with an Euler circuit has all vertices even-valent.

   II. False. It is necessary but not sufficient that a graph be connected in order to have an Euler circuit. In addition, each vertex, must have an even valence.

   III. True.

2.

From M go to R:	60
From R go to N:	30
From N go to P:	20
From P go to S:	40
From S go to Q:	55
From Q go to M:	90
	295

3. The intercom system does not need to form a circuit; it merely needs to be connected. Therefore, the problem is solved by applying Kruskal's algorithm to find a minimum – cost spanning tree connecting the offices.

4. Using the critical path scheduling algorithm, the priority list is $T_3T_5T_2T_6T_1T_4T_8T_7T_9$.

5. The problem is best solved by using the worst-fit algorithm for bin packing.

6. This type of study is a prospective study since it follows the children over a long period of time.

7. Find the class mark for each class: 3, 8, 13, 18, 23, 28, 33.
   Enter the class marks in L_1 and the number of calls in L_2.

   Choose 1-VarStats L_1, L_2, from the CALC menu.

   $\bar{x} = 13.92$
   $s = 8.51$

8. $y = 20 + 0.273x$
   $y = 20 + 0.273(40)$
   $y = 30.92$ hr

9. The smallest sum is $3(1+1+1)$. The largest sum is $18(6+6+6)$. The total number of outcomes is 16 as there are 16 numbers between 3 and 18 inclusive.

10. The sample space is $S = \{HHH, HHT, HTH, HTT, THH, THT, TTH, TTT\}$. Each outcome has probability $\frac{1}{8}$.
Three outcomes are in the event "exactly two heads". The probability of rolling exactly two heads is $3 \bullet \frac{1}{8} = \frac{3}{8}$.

11. $\mu = s_1p_1 + s_2p_2 + s_3p_3 + s_4p_4 + s_5p_5 + s_6p_6 + s_7p_7$
$\mu = 0(0.02) + 1(0.08) + 2(0.10) + 3(0.24) + 4(0.36) + 5(0.15) + 6(0.05)$
$\mu = 3.49$

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

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

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

$$s_{\hat{p}} = 1.24\%$$

13. Approximately 95% of the data fall within 2 standard deviations of the sample mean.

$$\bar{x} \pm 2\sigma_{\bar{x}} = \bar{x} \pm 2 \cdot \frac{\sigma}{\sqrt{n}}$$

$$= 15.1 \pm 2 \cdot \frac{1.9}{\sqrt{75}}$$

$$= 15.1 \pm 0.4$$

The 95% confidence interval is 14.7 yr to 15.5 yr.

14. Nine sample means in a row either above or below the target value signals that a process is out of control.

15. The target value is 12lb.
$\sigma = 3.2$ lb
$n = 10$

Control limits: $\mu \pm 3\frac{\sigma}{\sqrt{n}} = 12 \pm 3 \cdot \frac{3.2}{\sqrt{10}} = 12 \pm 3.04$

The control limits are from 8.96 lb to 15.04lb

16. 162 + 158 = 320 11-year-olds play baseball and soccer.

$\frac{158}{320} = 49.4\%$ of 11-year-olds play soccer.

17. I. True
II. False
III. True

18. 75% of 24 = .75 (24) = 8

75% approval requires that a nominee gain at least 18 votes.

Nominee	A	B	C	D	E	F	G	H	I	J
Number of Votes	21	18	14	11	19	13	16	5	13	19

Applicants A, B, E and J are admitted.

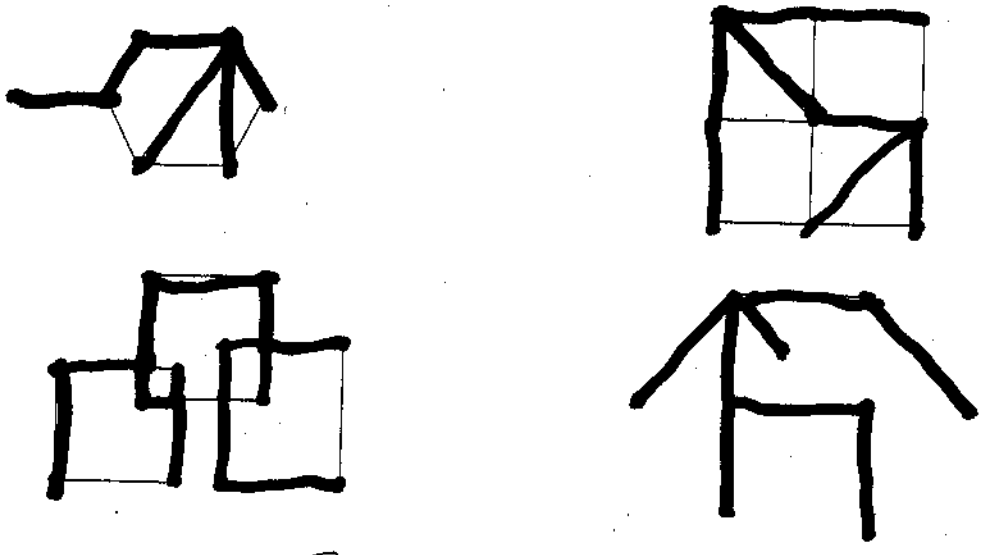
Name:_____ **Section:**_____

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

19. Match the following terms with their definitions (10 points).

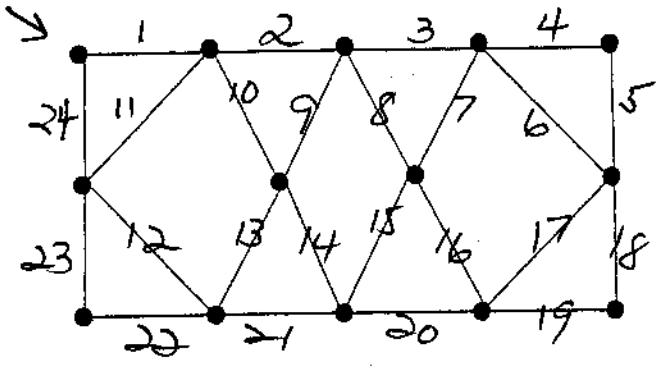
Connected graph	B	A. The effect of a dummy treatment on the response of subjects.
Critical path	E	B. A graph in which it is possible to reach any vertex from any other vertex.
Euler circuit	C	C. A circuit that traverses each edge of a graph exactly once.
Path	H	D. A sample chosen by chance.
Spanning tree	I	E. The longest path in an order-requirement digraph.
Convenience sample	J	F. An experiment to compare two or more treatments in which subjects are assigned to treatments by chance.
Simple random sample	D	G. The effects of two variables on the outcome of a study cannot be distinguished from one another.
Randomized comparative experiment	F	H. A connected sequence of edges.
Placebo effect	A	I. A subgraph of a connected graph that is a tree and includes all the vertices of the original graph.
Confounding	G	J. A sample that consists of individuals who are most easily available.

20. Find a spanning tree for each of the following graphs (8 points).



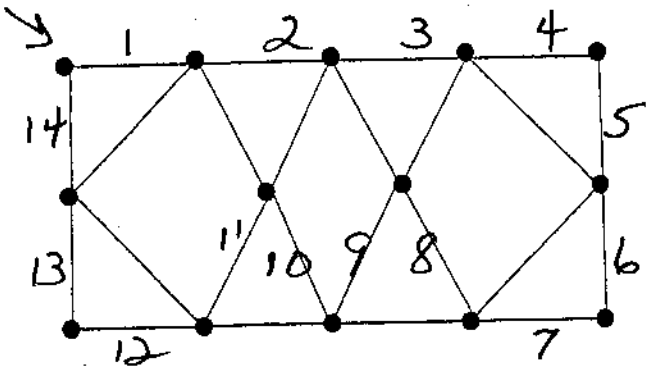
Possible trees

21. a. Does the graph shown below have an Euler circuit? If yes, show it by following the edges in numerical order or use arrows to indicate the direction of the circuit (6 points).



The graph has an Euler Circuit. Here is one possible Circuit

b. Does the graph shown below have a Hamilton circuit? If yes, show it by following the edges in numerical order or use arrows to indicate the direction of the circuit. (6 points).



The graph has a Hamiltonian Circuit. Here is one possible Circuit

22. The following data shows ages at which teenagers and adults enrolled in an aerobics class (10 pts):

15	27	22	38	16	46
34	17	43	29	16	29
43	48	39	32	44	18
27	18	42	34	34	16
47	42	34	22	32	29

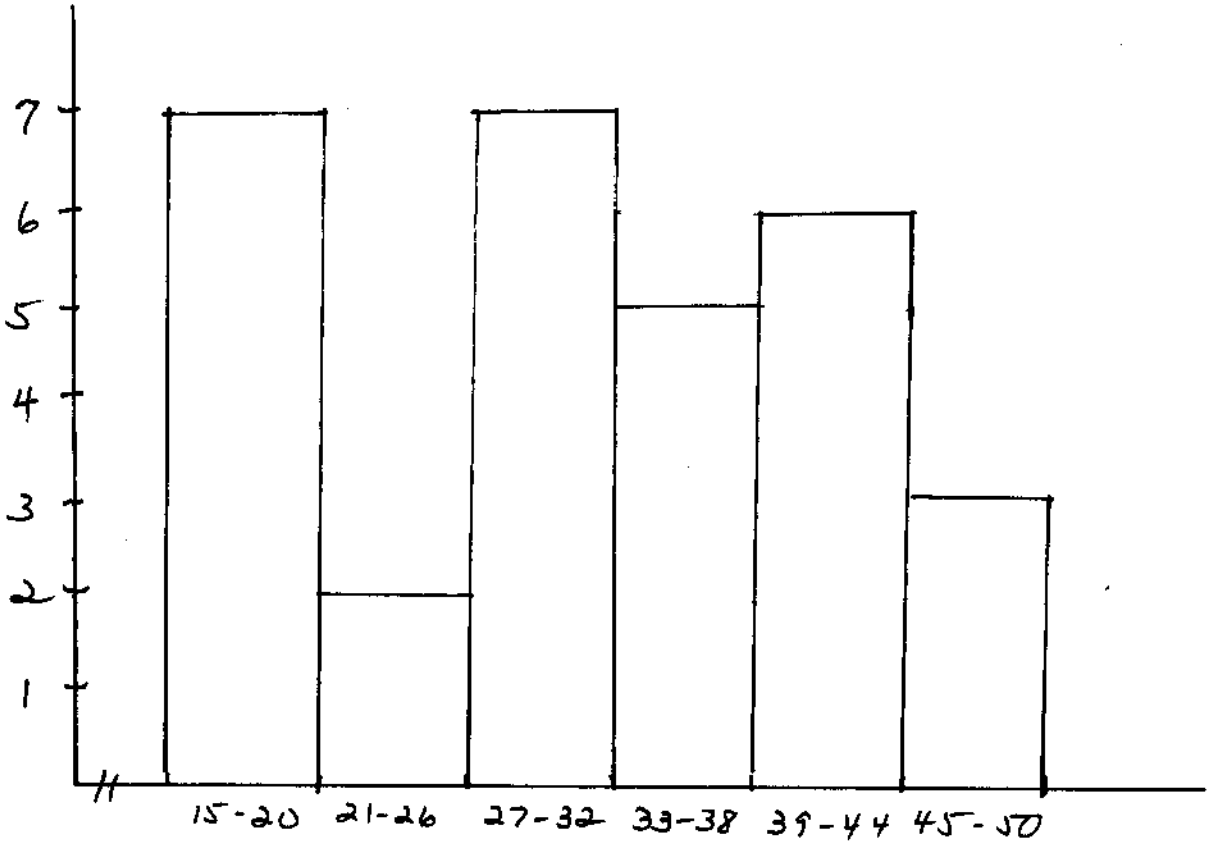
a. Construct a frequency distribution for this data using 6 classes.

H - L = 48 - 15
= 33

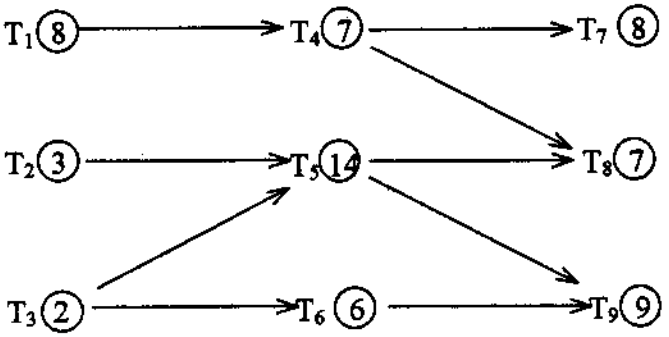
Class width = $\frac{33}{6}$
= 5.5
≈ 6

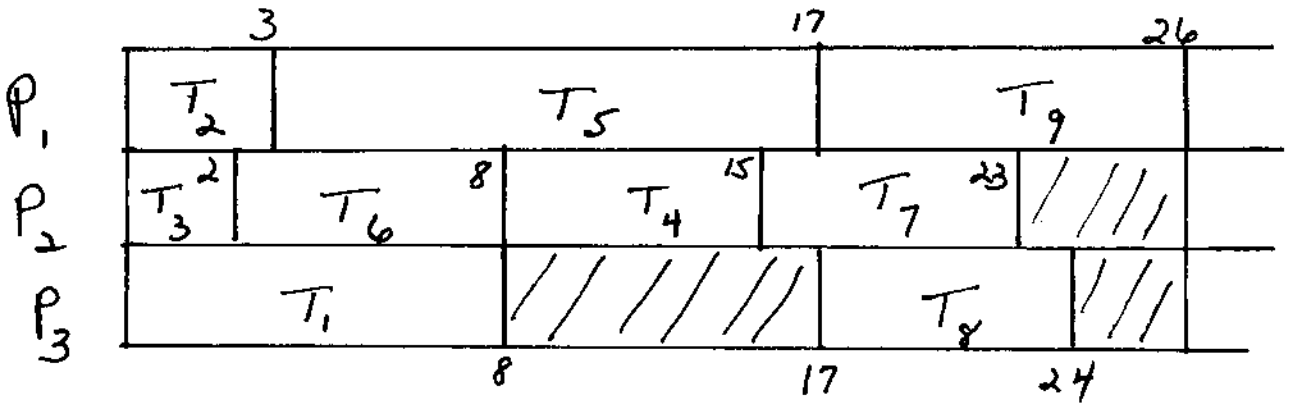
Classes	Tally	Frequency
15 - 20	𝍸 II	7
21 - 26	II	2
27 - 32	𝍸 II	7
33 - 38	𝍸	5
39 - 44	𝍸 I	6
45 - 50	III	3
		30

b. Construct a frequency histogram for this data using 6 classes.



23. Given the order-requirement digraph below (with time given in minutes) and the priority list $T_2, T_3, T_1, T_5, T_4, T_6, T_9, T_7, T_8$, apply the list-processing algorithm to construct a schedule using three processors (9 pts).





Finished: $T_3, T_2, T_6, T_1, T_4, T_5$

24. (11 pts) Voters are to elect one of five candidates: A, B, C, D, or E. Their preference lists are shown below:

Number of Voters	5	3	8	7	4
First choice	C	D	E	B	A
Second choice	B	A	B	A	D
Third choice	D	C	A	C	C
Fourth choice	E	B	C	D	E
Fifth choice	A	E	D	E	B

Which candidate wins using:

a. plurality? A = 4
B = 7 E is the winner
C = 5
D = 3
E = 8

b. the Borda count?

A: 4·4 + 10·3 + 2·8 + 5·0 = 62
B: 7·4 + 13·3 + 3·1 + 4·0 = 70 B is the winner
C: 5·4 + 14·2 + 8·1 = 56
D: 3·4 + 4·3 + 5·2 + 7·1 + 8·0 = 41
E: 8·4 + 9·1 + 10·0 = 41

c. sequential pairwise voting with agenda ABCDE?

A vs B		B vs C		B vs D		B vs E		B is the winner
7	20	15	12	20	7	15	12	

d. the Hare system?

Round 1: Eliminate D
Round 2: Eliminate C
Round 3: Eliminate A B is the winner
Round 4: B has a majority