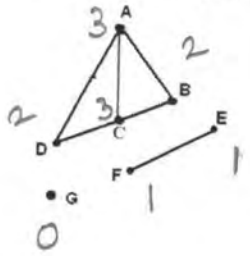
Exam 1 Practice Problems

1. Answer the following questions about the graph below:



a) How many vertices does the graph have? 7

b) How many edges does the graph have? 6

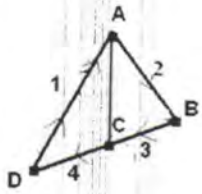
c) Is the graph connected? If it is not connected, how many components does it have? SUB-GRAPHS 3

d) Write down the valences of all vertices:

2. Classify the path on the graph to the right. Mark all true answers.

(A) Not a circuit
(B) A circuit
(C) An Euler circuit
(D) A Hamiltonian circuit
(E) Not a path

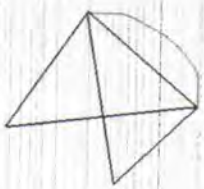
DABCD



3. Do the graphs below have an Euler circuits? If not, explain why. If yes, find such a circuit

both are connected and...

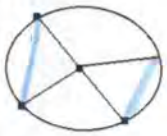
Euler path – 2 of odd degree



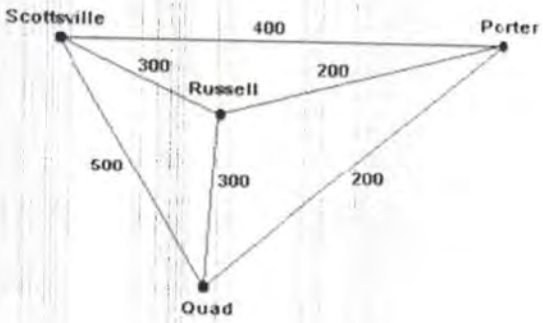
Euler circuit - all even

4. Eulerize the following graph by adding some extra edges (do not find Euler circuit!).

double up on two edges



5. Use the nearest neighbor algorithm starting at Scottsville to solve the traveling salesman problem for the graph of the four cities shown on the right. How many different Hamiltonian circuits exist on this graph?



$S \xrightarrow{300} R \xrightarrow{200} P \xrightarrow{200} Q \xrightarrow{500} S$

1200 "units"

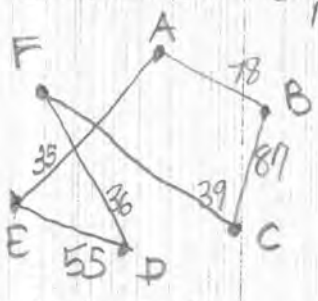
6. How many different Hamiltonian circuits exist on a complete graph with 6 vertices?

$\frac{6!}{2} = 360$ but only $\frac{(6-1)!}{2} = 60$ if starting city is given

7. Using the mileage chart on the below, find the lowest cost solution for a traveling salesman problem t using the sorted edges algorithm. All distances are given in km.

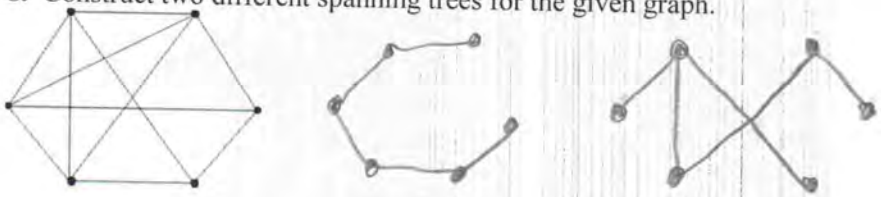
	A	B	C	D	E	F
A	0	78	173	186	35	111
B	78	0	87	199	162	44
C	173	87	0	168	90	39
D	186	199	168	0	55	36
E	35	162	90	55	0	52
F	111	44	39	36	52	0

AE FD FC BF EF ED AB BC
35, 36, 39, 44, 52, 55, 78, 87, 90, 111
NO NO done



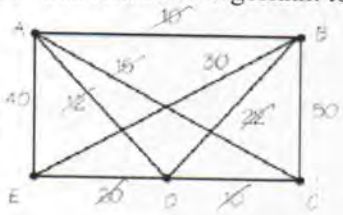
330 km
(NN gives 456 km)
AEFDCBA

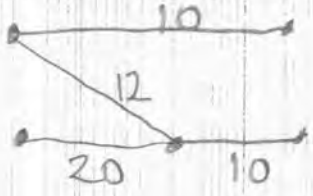
8. Construct two different spanning trees for the given graph.



etc = no new edges no cycles

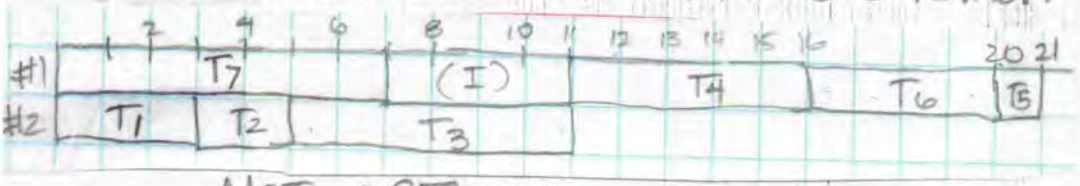
9. Use Kruskal's algorithm to find the minimum cost spanning tree for the given graph:



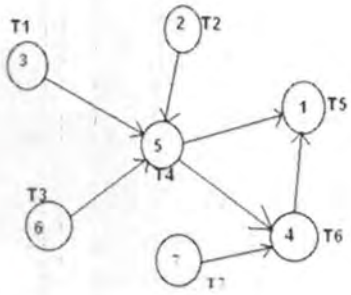


10, 10, 12, 15, 20, 22, 30, 40, 50 (NO)
COST 52 "units"

10. Given the order-requirement digraph on the right and the priority list
T7, T5, T6, T4, T1, T2, T3,
apply the list processing algorithm to construct a schedule using two processors.
Is this schedule optimal? CPath T3 T4 T6 T5 @ 16 min

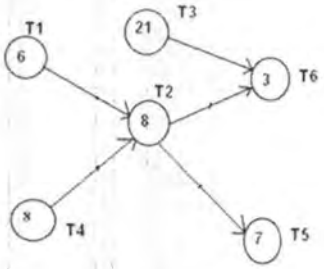


NOT OPTIMAL



11. Find the critical path scheduling priority list for the digraph on the right.

T3, T4, T1, T2, T5, T6



12. Schedule the following independent tasks on three processors and determine if the schedule is optimal or not
16, 10, 16, 20, 7, 20, 17, 17, 8, 8, 18, 16, 8, 19, 13

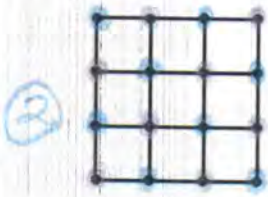
75 min > $\frac{213}{3} = 71$
NOT OPTIMAL

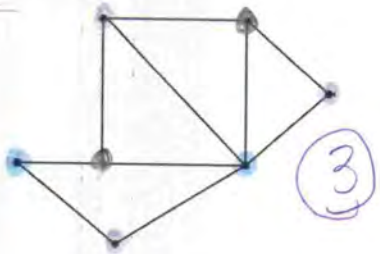
13. Use the first fit, next fit, best fit and worst fit packing algorithm to pack the following weights into bins that can hold no more than 9 pounds: 5 lbs, 7 lbs, 1 lb, 2 lbs, 4 lbs, 5 lbs, 1 lb, 1 lb, 3 lbs, 6 lbs, 2 lbs

	NF	FF	BF	WF
#1	5 X	5, 1, 2, 1	5, 2, 1	5, 1, 2, 1
#2	7, 1 X	7, 1	7, 1, 1	7, 1
#3	2, 4 X	4, 5	4, 5	4, 5
#4	5, 1, 1 X	3, 6	3, 6	3, 6
#5	3, 6 X	2	2	2
#6	2			

optimal
$\frac{37}{9} = 4.1$
5 min

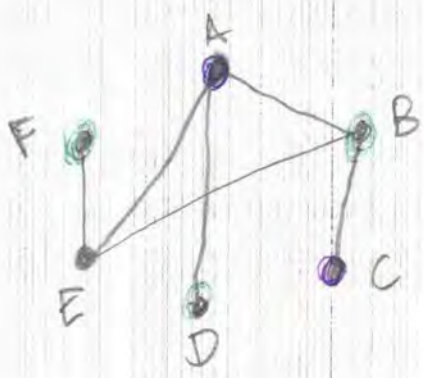
14. Find the chromatic number of the given graphs:





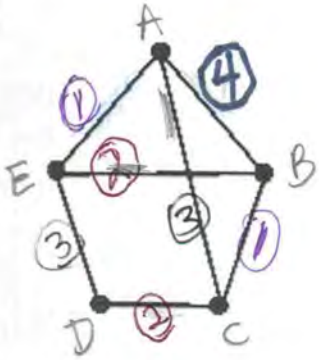
15. An architecture firm must schedule meeting times for its working groups. The following chart indicates which projects have overlapping members for their working groups. Create a graph that would be used to decide how many different meeting times would be required. What is the fewest meeting times needed?

	A	B	C	D	E	F
A		X		X	X	
B	X		X		X	
C		X				
D	X					
E	X	X				X
F					X	



3 times

16. The given graph represents a scheduling problem with each vertex representing a team and each edge representing a game that needs to be played. What is the fewest number of game days that will allow all the remaining match-ups to occur?



17. What is the fewest colors needed to color the graph

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