Sample Exam 2

Name _____SOLUTIONS_____
TA Name _____

Be sure to use a #2 pencil. Calculators are allowed, but cell phones or palm pilots are NOT acceptable.

MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

Use the following to answer questions #1 – #10.
There are 30 seats available on the Fairy Tale Council to be divided among the Heroes, Super Villains, and Magical Creatures. The Heroes have a population of 192. The Super Villains have a population of 207. The Magical Creatures have a population of 504.

1) What is the standard divisor? (192+207+504)/30=30.1
   A) 30.1
   B) 903
   C) 6.38
   D) 6.88
   E) 16.74

2) What are the standard quotas for the Heroes, Super Villains, and Magical Creatures respectively?
   A) 6.38, 6.88, 16.74
   B) 6.4, 6.9, 16.8
   C) 6, 7, 17 192/30.1=6.3787, 207/30.1=6.877, 504/30.1=16.744
   D) 6, 6, 17
   E) None of the above.

3) What are the lower quotas for the Heroes, Super Villains, and Magical Creatures respectively?
   A) 6.38, 6.88, 16.74
   B) 6, 6, 16 (round down for lower quota)
   C) 6, 7, 17
   D) 6, 6, 17
   E) None of the above.

4) What is the final apportionment of seats under Hamilton's Method?
   A) 6, 6, 18
   B) 6, 8, 16
   C) 7, 7, 16
   D) 6, 7, 17 largest fractions are 0.88 and 0.74, so those populations get the extra seats.
   E) None of the above.

5) What are the relative fractional parts for the Heroes, Super Villains, and Magical Creatures respectively?
   A) 0.063, 0.147, 0.046 0.88/6=0.063, 0.88/6=0.147, 0.75/16=0.046
   B) 0.38, 0.88, 0.74
   C) 6, 6, 16
   D) 15.79, 6.82, 21.62
   E) None of the above.

6) What is the final apportionment of seats under Lowndes' Method?
   A) 6, 6, 18
   B) 6, 8, 16
   C) 7, 7, 16 largest fractional parts are 0.147 and 0.063
   D) 6, 7, 17
   E) None of the above.

7) Which of the following would be a modified divisor for Jefferson's Method?
   A) 28 gives: 6.857, 7.39, 18 and 6+7+18 = 31
   B) 29 gives: 6.62, 7.14, 17.379 and 6+7+17 = 30 works!
   C) 30 gives: 6.4, 6.9, 16.9 and 6+6+16 = 28 not enough seats allocated
   D) 31 if 30 didn't work, 31 will be worse.
   None of the above.

8) In 5 years, the Magical Creatures population increases, and the other populations stay the same. When seats are reallocated, the Magical Creatures lose a seat and the Super Villains gain a seat. Which of the following apply?

A) Alabama Paradox
B) Violation of the Quota Rule
C) Population Paradox
D) New States Paradox
E) None of the above.

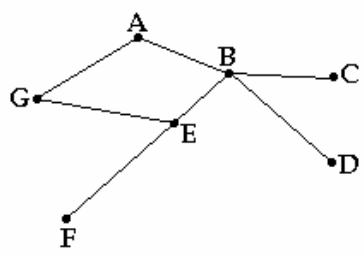
9) How does Webster's Method differ from Jefferson's Method? (You may select more than one answer.)

A) Webster's Method allocates upper quotas.
B) Webster's Method does conventional rounding with a modified divisor.
C) Webster's Method doesn't differ.
D) Webster's Method does conventional rounding with the standard divisor.
E) None of the above.

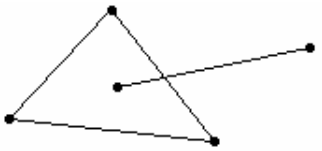
10) Identify the bridges in the graph to the right:

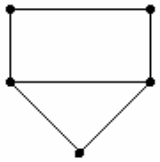
A) BC, BD, and EF
B) BC, BD, BE, and EF
C) BC and BD
D) EF only
E) There are no bridges in the graph.

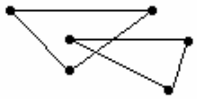
(example: F would be isolated if EF were removed.)

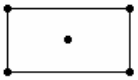


11) Which of the following graphs are NOT connected? (You may select more than one answer.)


Graph A


Graph B


Graph C

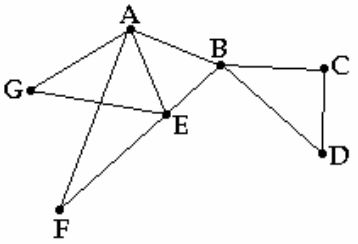

Graph D

A) Graph A
B) Graph B
C) Graph C
D) Graph D
E) None of the above.

Use the following graph to answer questions #12 and #13.

12) What is the degree of vertex A?

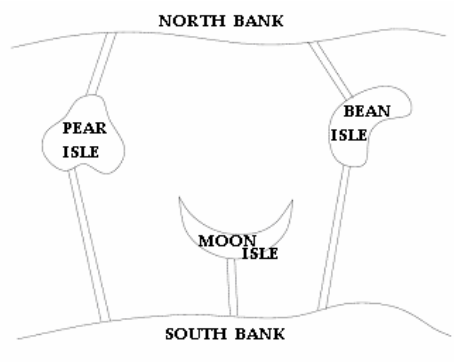
A) 1
B) 2
C) 3
D) 4
E) None of the above.



13) Which of the following illustrates an Euler circuit?

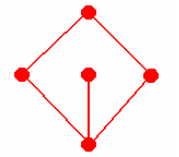
A) A, B, C, D, E, F, G, A
B) A, B, C, D, E, F, A
C) A, B, C, D, E, G, A
D) A, B, C, D, B, E, F, A, G, E, A (all vertices are included and each edge is traveled exactly once)
E) Euler circuit not possible. (Graph has all even vertices, so an Euler circuit exists…)

There is a river running through the middle of Citytown. There are 3 isles and 5 bridges as shown in the figure. Use the figure to answer questions #14 and #15:



14) A graph that appropriately models this situation would have

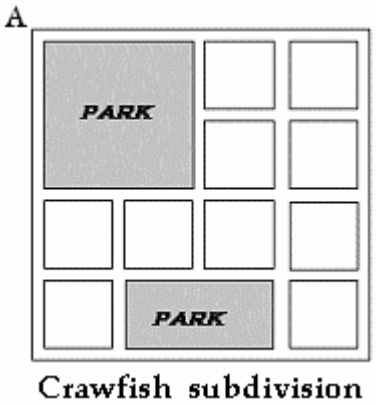
A) 5 vertices and 5 edges
B) 9 vertices and 9 edges
C) 5 vertices and 6 edges
D) 3 vertices and 2 edges
E) None of the above.

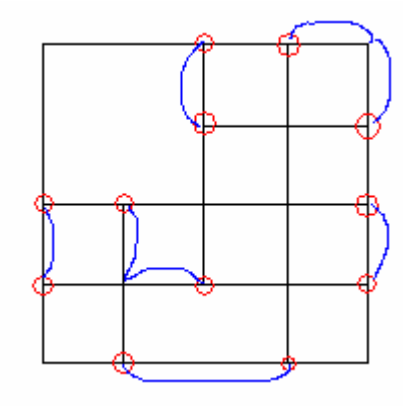


15) It is possible to take a walk through this town, starting on Moon Island, crossing each bridge once (and only once) and ending

A) on the North Bank
B) on Kidney Bean Island
C) on the South Bank
D) on Pear Island
E) None of the above.

Use the following to answer question #16. A night watchman must walk streets of the Crawfish subdivision. He only needs to walk only once along each street (including parks). The night watchman wants to travel a route in the most efficient possible way.





16) An optimal Eulerization of the graph that models this problem can be obtained by adding

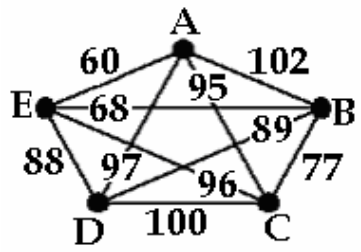
A) 14 edges
B) 9 edges
C) 12 edges
D) 8 edges
E) None of the above

17) In a connected graph with 143 edges, what is the sum of the degrees of all the vertices?

A) 143
B) 72
C) 286 each edge contributes 2 degrees
D) Cannot be determined.
E) None of the above.

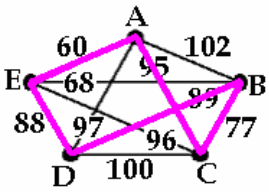
Use the graph to answer questions #18 - #21

Note: There are **extra copies** of the graph on the next page.



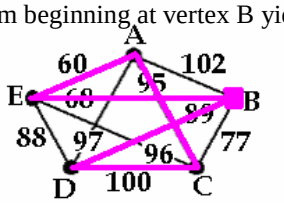
18) The nearest-neighbor algorithm beginning at vertex E yields the following Hamilton circuit:

A) E, C, B, D, A, E
B) E, B, D, C, A, E
C) E, A, C, B, D, E
D) E, A, B, C, D, E
E) None of the above.



19) The nearest-neighbor algorithm beginning at vertex B yields the a Hamilton circuit of weight:

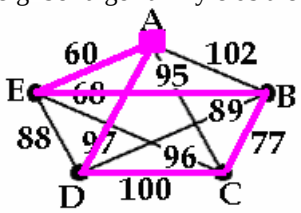
A) 427
B) 412
C) 409
D) 402
E) None of the above.



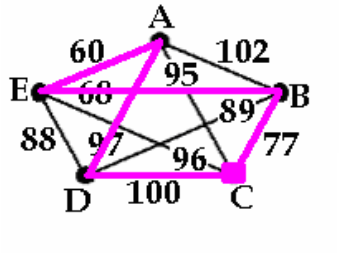
60+95+100+89+68=412

20) The repetitive nearest neighbor algorithm yields the following Hamilton circuit:

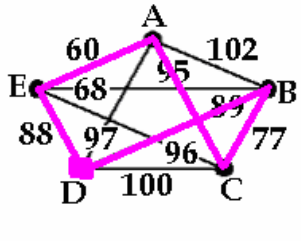
A) A, B, C, D, E, A
B) A, D, C, B, E, A
C) A, C, B, D, E, A
D) A, C, D, B, E, A
E) None of the above.



60+68+77+100+97=402



Weight = 402

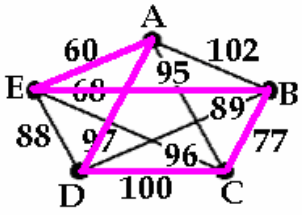


Weight = 409

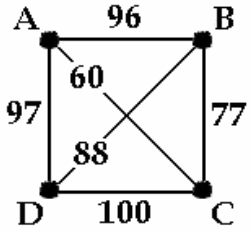
Cheapest weight is 402, or the circuit A,D,C,B,E,A

21) The cheapest link algorithm yields a Hamilton circuit of weight:

A) 427
B) 412
C) 409
D) 402
E) None of the above.

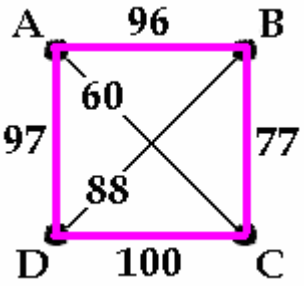


Use the graph to answer question #22. There are extra copies of the graph at the bottom of this page.

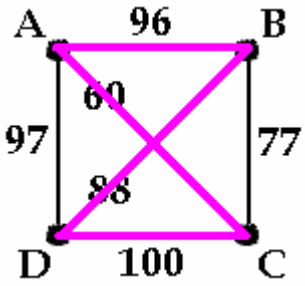


22) The Brute Force Algorithm applied to the following graph yields a Hamilton circuit of weight:

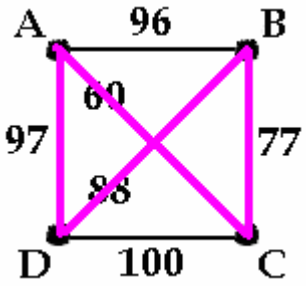
A) 344
B) 322
C) 370
D) 321
E) None of the above



Weight = 370



Weight = 344



Weight = 332 (cheapest)

23) What is the degree of every vertex in a complete graph of 10 vertices?

A) 100
B) 11
C) 9 (N-1)
D) 10
E) None of the above.

24) Which algorithm guarantees the optimal Hamilton circuit for a complete graph?

F) Cheapest Link
G) Fleury's Algorithm
H) Repetitive Nearest Neighbor
I) Kruskal's Algorithm
J) None of the above (Brute Force Algorithm)