

Name: _____

Mark Version C

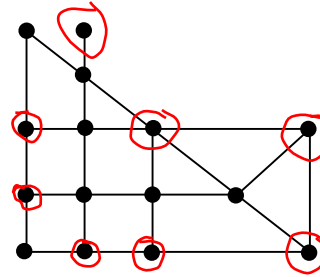
Use a #2 pencil. Calculators are allowed, but cell phones/ipods etc. are NOT acceptable. Please turn cell phones off.

Choose the alternative that best completes the statement or answers the question and mark your answer on the scantron form. Scantrons with no answers marked will receive a score of 0.

Use the graph below to answer questions 1-2. The same graph is provided twice.

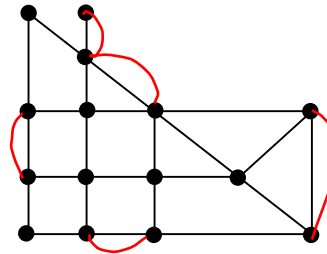
1. How many vertices are odd?

- A) 5
- B) 7
- C) 8**
- D) 10
- E) None of the above.



2. How many edges are added in an optimal eulerization of the graph?

- A) 5**
- B) 4
- C) 3
- D) 10
- E) None of the above.

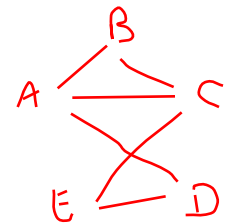


Use the following description for problems 3-4.

Stacie's dream recycling plant consists of 5 separate buildings, connected by catwalks. Call the buildings A, B, C, D, and E. The catwalks would connect the following: A and B, A and C, A and D, B and C, E and C, and E and D.

3. Which of the following graphs accurately models this situation?

- (a)
- (b)**
- (c)
- (d)



(e) None of the above.

4. Stacie would like to take Kristin on a tour of her Recycling Center, crossing each Catwalk exactly once. Which of the following is true?

- A) This is possible, if they start at A or C.**
- B) This is only possible if they start from A.
- C) This is possible, and they can start anywhere.
- D) This is possible if you start at E or D.
- E) None of the above.

Euler Path possible from odd vertices

Use the following information for questions 5 - 10.

There are 33 seats available for the League of Death to be divided among the Zombies, Vampires, and Werewolves based on population.

	Zombies	Vampires	Werewolves
Population	235	251	424

Total population
910

5. What is the standard divisor?

- A) 27.58
- B) 33
- C) 28
- D) 29.32
- E) None of the above.

$$\frac{910}{33} = 27.5757\overline{57}$$

6. What are the standard quotas for the Zombies, Vampires, and Werewolves respectively?

- A) 8.01, 8.56, 14.46
- B) 9, 9, 15
- C) 8.52, 9.10, 15.37
- D) 8.39, 8.96, 15.14
- E) None of the above.

$$\frac{235}{27.58} = 8.52$$

$$\frac{424}{27.58} = 15.37$$

$$\frac{251}{27.58} = 9.10$$

7. What are the lower quotas for the Zombies, Vampires, and Werewolves respectively?

- A) 8, 9, 14
- B) 8, 9, 15
- C) 8, 8, 15
- D) 9, 9, 15
- E) None of the above.

ignore stuff after the decimal

8. What is the final apportionment of seats under Hamilton's method to the Zombies, Vampires, and Werewolves respectively?

- A) 8, 9, 16
- B) 9, 10, 14
- C) 8, 10, 15
- D) 9, 9, 15
- E) None of the above.

$$8 + 9 + 15 = 32$$

1 surplus seat

.52 is largest decimal

Zombies

9. What are the relative fractions under Lowndes' Method for the Zombies, Vampires, and Werewolves, respectively?

- A) 0.00125, 0.07, 0.033
- B) 0.048, 0.12, 0.0093
- C) 0.065, 0.011, 0.025
- D) 0.39, 0.96, 0.14
- E) None of the above.

$$\frac{0.52}{8} = .065$$

$$\frac{0.37}{15} = 0.0247$$

$$\frac{0.10}{9} = 0.011$$

10. Which of the following would be a modified divisor for Jefferson's Method?

- A) 27.8 X
- B) 28.2 X
- C) 26.5 }
- D) 27 }
- E) None of the above.

27.58 is too large

$$\frac{235}{26.5} \rightarrow 8$$

$$\frac{251}{26.5} \rightarrow 9$$

$$\frac{424}{26.5} \rightarrow 16$$

$$8 + 9 + 16 = 33$$

$$\frac{235}{27} \rightarrow 8$$

$$\frac{251}{27} \rightarrow 9$$

$$\frac{424}{27} \rightarrow 15$$

too large still.

11. Adams's Method is different from Webster's Method in what ways?

- A) Adams's Method chooses upper quotas to sum number of seats *true*
- B) Adams's Method never violates quota rule. *- false*
- C) Adams's Method chooses lower quotas to sum number of seats. *- false*
- D) Adams's Method **doesn't** differ from Webster's Method. *- false*
- E) None of the above.

12. Which of the following best describes the Alabama Paradox?

- A) X loses a seat to Y even though X's population grew at a higher rate Y's. *Population*
- B) Adding a New State and seats can affect the apportionment of other states. *New State*
- C) An increase in the total number of seats being apportioned, in and of itself, forces a state to lose one of its seats. *★*
- D) is a seemingly true statement or group of statements that lead to a contradiction or a situation which seems to defy logic or intuition. *?*
- E) None of the above.

13. Which apportionment method will not violate the quota rule, will not produce any paradoxes and will not show bias between small and large states? *↓*

- A) Fleury *- Not an apportion method*
- B) Jefferson
- C) Hamilton
- D) Adams
- E) None of the above.

This is Not possible

14. What is the degree of any vertex in K_{29} ?

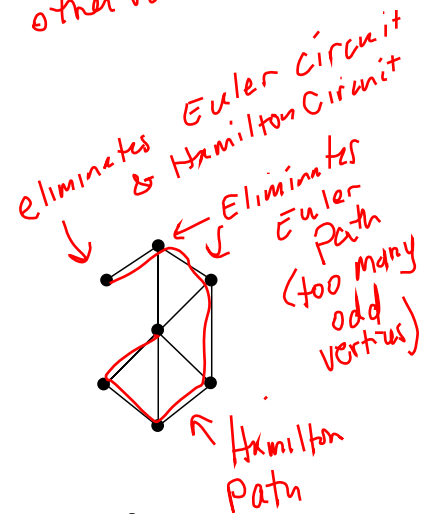
- A) $29(28)/2$
- B) 28
- C) 29!
- D) 28!
- E) None of the above.



points to N-1 other vertices

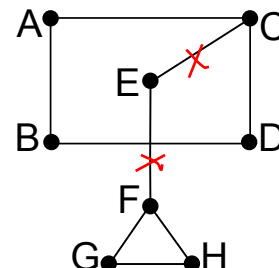
15. Which of the following is true about the graph to the right?

- A) This graph has a Hamilton Path only.
- B) This graph has an Euler Circuit and a Hamilton Path.
- C) This graph has an Euler Circuit only.
- D) This graph has a Hamilton Circuit and an Euler Path.
- E) None of the above.



16. Identify the bridges in the graph to the right.

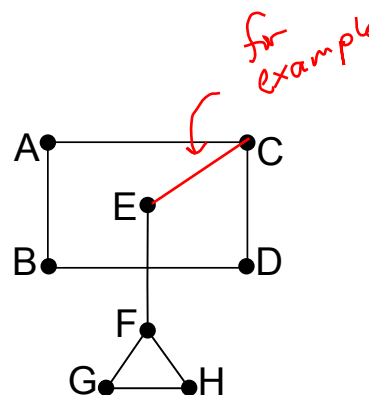
- A) FG and FH
- B) EF only
- C) CE and EF
- D) Every edge is a bridge in this graph.
- E) None of the above.



Use the graph below and to the right to answer questions 17-19.

17. What would you have to do to the graph to make it a connected graph?

- A) Get rid of the bridges. ~~X~~
- B) It is a connected graph. ~~X~~
- C) You would have to make each vertex even. ~~X~~
- D) You would have to have add one edge. Yes**
- E) None of the above.



18. Which of the following is a circuit in the graph?

- A) A, B, C, D, E, F, G, H, F ~~X~~ → must start and stop at the same
- B) A, B, D, C, A** ← not connected vertex
- C) A, B, D, C, E, A ~~X~~
- D) E, F, G, H ~~X~~
- E) None of the above.

19. An Euler Circuit would start and end at which vertex?

- A) A or B or C or D.
- B) D
- C) E
- D) An Euler Circuit is not possible.**
- E) None of the Above.

Euler needs Every Edge
not possible
if the graph is
disconnected

20. Identify the true statement from the list below.

- A) The Brute Force Algorithm will always give a better result than the Cheapest-Link Algorithm. ~~Some times Cheapest link finds an optimal solution.~~
- B) The Cheapest-Link Algorithm will always give a result better than or equal to the result from the Repetitive Nearest-Neighbor Algorithm. ~~No.~~
- C) The Repetitive Nearest-Neighbor Algorithm will always give a result better than or equal to the result from the Nearest-Neighbor Algorithm. Yes**
- D) The Nearest Neighbor Algorithm can give a better result than the Brute Force Algorithm. ~~No - Brute Force will find optimal solution~~
- E) None of the above statements are true or more than one statement is true.

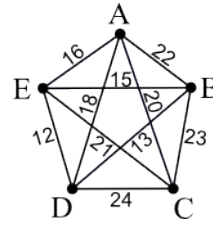
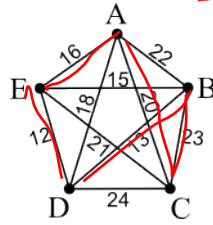
Sometimes Cheapest-Link
finds a better solution
and sometimes Repetitive
Nearest Neighbor finds a better
solution.

Questions 21 - 24 refer to the same graph. Extra copies have been provided in the questions below.

21. The Cheapest-Link Algorithm yields a Hamilton Circuit of weight:

- A) 93
- B) 84**
- C) 87
- D) 90
- E) None of the above.

$12 + 13 + 16 + 20 + 23$

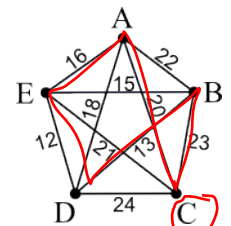
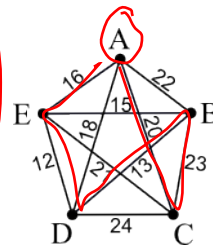
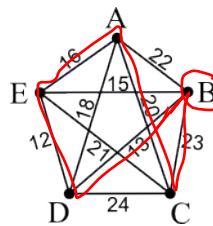


Mark cheapest edges, don't make circuits, or 3 edges from a vertex

skip 15, 19

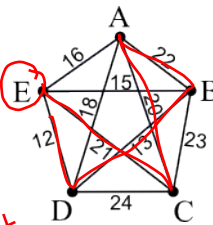
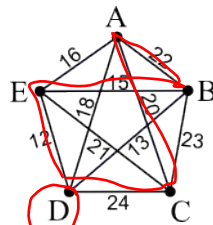
22. The Nearest-Neighbor Algorithm beginning at vertex B yields a Hamilton Circuit of weight:

- A) 84**
- B) 80
- C) 93
- D) 88
- E) None of the above.



23. The Repetitive Nearest-Neighbor Algorithm yields the following Hamilton Circuit:

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



Best A C B D E A or D E A C B D

$12 + 15 + 22 + 20 + 21 = 93$

$12 + 13 + 22 + 20 + 21 = 88$

24. Consider using the Nearest-Neighbor Algorithm starting at vertex A. Which other start vertices produce the same circuit?

- A) Vertex D only
- B) Vertices B and C only**
- C) Vertex E only
- D) Vertex B only
- E) None of the above.

Shape if start @ A;



also get this shape if start at:

B, C

(and cheapest-link)