Instructions: *The following homework assignment will help to prepare you for test 3. This homework assignment will be collected on the day of the test.*

Use the following data for questions 1-8. People were told to rank their preferences for the location of a party: (H)otel, (S)chool, and (R)estaurant.

Number of ballots	12	18	25	6	12	8
First Choice	H	H	R	R	S	S
Second Choice	S	R	H	S	H	R
Third Choice	R	S	S	H	R	H

(1) How many votes were cast?
    (a) 80
    (b) 84
    (c) 76
    (d) 112
    (e) none of the above

(2) Find the plurality winner.
    (a) tie between school and hotel
    (b) school
    (c) restaurant
    (d) hotel
    (e) none of the above

(3) What percentage (to the nearest whole) of the votes did the winner in problem 2 receive?
    (a) 51
    (b) 32
    (c) 39
    (d) 42
    (e) none of the above

(4) Use instant run-off to determine the winner using plurality with elimination.
    (a) tie between school and hotel
    (b) school
    (c) restaurant
    (d) hotel
    (e) none of the above

Same table as previous page copied for convenience.

Number of ballots	12	18	25	6	12	8
First Choice	H	H	R	R	S	S
Second Choice	S	R	H	S	H	R
Third Choice	R	S	S	H	R	H

(5) Use the Borda method to determine the winner.
    (a) tie between school and hotel
    (b) school
    (c) restaurant
    (d) hotel
    (e) none of the above

(6) How many votes did the winner in problem 5 receive?
    (a) 211
    (b) 170
    (c) 166
    (d) 158
    (e) none of the above

(7) Determine the winner using the pairwise comparison method.
    (a) tie between school and hotel
    (b) school
    (c) restaurant
    (d) hotel
    (e) none of the above

(8) How many points did the winner in problem 7 receive?
    (a) 2
    (b) $1\frac{1}{2}$
    (c) 1
    (d) $\frac{1}{2}$
    (e) none of the above

The information you will need to answer questions 9-13 will not be found in your notes. It can be found in[3] the reading material of chapter 6 in the text.

(9) Which fairness criteria is always satisfied by instant runoff?
    (a) monotonicity
    (b) majority
    (c) irrelevant alternatives
    (d) head to head
    (e) none of them are always satisfied

(10) Which fairness criteria states that if X wins the election and if the only changes favor X for a subsequent election, then X should be the winner?
    (a) monotonicity
    (b) majority
    (c) irrelevant alternatives
    (d) head to head
    (e) some other one

(11) Which fairness criteria is always satisfied by the Borda count?
    (a) monotonicity
    (b) majority
    (c) irrelevant alternatives
    (d) head to head
    (e) none of them are always satisfied

(12) Which fairness criteria may not be satisfied by the pairwise comparison method?
    (a) monotonicity
    (b) majority
    (c) irrelevant alternatives
    (d) head to head
    (e) all of them are satisfied with this method

(13) Which fairness criteria might be broken by all of the voting methods in chapter 6?
    (a) monotonicity
    (b) majority
    (c) irrelevant alternatives
    (d) head to head
    (e) no criteria is broken by all methods

Use the data in the following table to respond to questions 14 to 21. Three states A, B, C have decided to form an interstate trade bureau. The bureau will have 20 seats. The state populations are shown below.

State	A	B	C
Population (1000's)	760	980	1350

(14) What is the total population?

(15) What is the standard divisor?

(16) Use the Hill-Huntington method to find the apportionment of the bureau seats.
   (a) A:5, B:6, C:9
   (b) A:5, B:7, C:8
   (c) A:4, B:7, C:9
   (d) A:5, B:8, C:7
   (e) none of the above

(17) Find the Hill-Huntington number for each state.

(18) If the bureau size is increased by one seat, which state would get the additional seat? Why?

(19) What is each state's lower quota?

(20) Apportion the 20 seats by Hamilton's method.

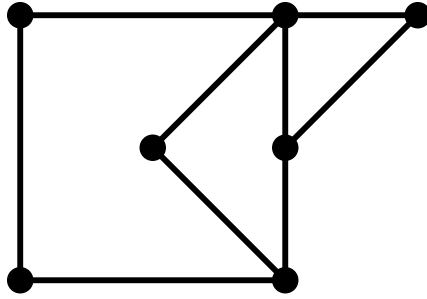(21) How did you decide which state(s) would get more than their lower quota?

FIGURE 1. Use this graph for questions 22 to 25.

(22) How many vertices have odd degree?

(23) How many vertices in the graph?

(24) The graph has
  (a) an Euler circuit but no Euler trails.
  (b) an Euler trail but no Euler circuits.
  (c) both an Euler circuit and an Euler trail.
  (d) neither an Euler circuit nor an Euler trail.

(25) If the above graph has an Euler circuit or an Euler trail, show it by numbering the edges and drawing arrow heads on the edges like we did in class. **OR** If the above graph has neither a Euler circuit nor an Euler trail, Eulerize it and then show the resulting Euler circuit by numbering the edges and drawing arrow heads like we did in class.

The graph below represents a street network that a newspaper carrier must travel to deliver a daily newspaper. All houses receiving a paper have a mail box on one side of the street so each edge need only be traversed once to deliver the newspapers.
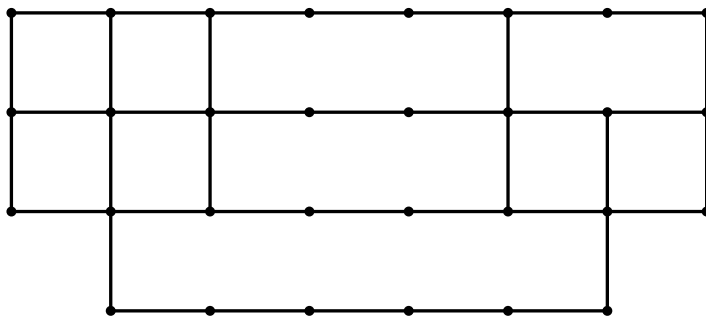

FIGURE 2. Use this graph for questions 26 and 27.

(26) Eulerize the graph above efficiently by duplicating as few edges as possible with dashed lines. Do **NOT** show the Euler circuit.

(27) What do the dashed lines represent from the point of view of the delivery person?