

**Math 1060: Chapter 13 Homework**

Name: \_\_\_\_\_

Score: \_\_\_\_ / 89 points

Due when you take Test 2

1. (9 points) Give precise mathematical definitions for the following terms.
  - (a) Cake-division procedure:
  
  
  
  
  
  
  
  
  
  
  - (b) Divide-and-choose:
  
  
  
  
  
  
  
  
  
  
  - (c) Equitable division procedure:
  
2. (9 points) Which term from class has the following definition?
  - (a) \_\_\_\_\_ A two-player fair-division procedure in which players independently bid on items' importance with 100 points. The items go to the player who bid more, before low point-ratio items are transferred from the winner to the loser.
  - (b) \_\_\_\_\_ A certain cake-division procedure for any number of players in which produces a proportional allocation.
  - (c) \_\_\_\_\_ The fraction in which the numerator is the number of points one party placed on an object, and the denominator is the number of points the other party placed on the object.
  
3. (12 points) For each of the following situations, indicate whether it would be solved best with an adjusted winner allocation, Knaster inheritance, or cake-division procedure.
  - (a) Two friends wandering in the woods, who have run out of water, find an unopened water bottle and wish to divide it equally.
  
  
  
  
  
  
  
  
  
  
  - (b) Two friends are wandering in the woods find a chest full of valuable items and wish to divide the items equally.
  
  
  
  
  
  
  
  
  
  
  - (c) A group of friends find a valuable, but illegally obtained, painting in an old storage unit.
  
  
  
  
  
  
  
  
  
  
  - (d) Two high school math teachers are trying to decide who will teach which class.

4. (10 points) In the adjusted winner procedure, the adjustment phase involves giving items with the lowest point-ratio from the winner to the loser. Why do we transfer the items with lowest point-ratio, instead of any other item?
5. (7 points) Suppose that a labor union and management are trying to resolve a dispute that involves four issues: the base salary of the worker, the annual salary increase that workers can expect, the benefits package the workers will receive, and the amount of vacation time to which each worker will be entitled. Use the adjusted winner procedure to resolve this dispute, with the following point assignments:

Issue	Labor	Management
Base salary	30	50
Salary increases	20	40
Benefits	35	5
Vacation time	15	5

6. (12 points) The adjusted winner procedure can also be used to resolve disputes. Mike and Phil are roommates in college and they encounter serious conflicts during their first week at school. Their resident adviser decides to use the adjusted winner procedure to resolve the dispute. The issues agreed upon, and the (independently assigned) points, are as follows.

Issue	Mike	Phil
Stereo level	4	22
Smoking rights	10	20
Room party policy	50	25
Cleanliness	6	3
Alcohol use	15	15
Phone time	1	8
Lights-out policy	10	2
Visitor policy	4	5

Use the adjusted winner procedure to resolve this dispute.

7. (20 points) Make up an example from your life where the adjusted winner procedure could be useful. List the issues and parties, make reasonable guesses as to each party's bid, and solve the problem.

8. (10 points) Three heirs are set to inherit several large items. They bid as follows:

<b>Item</b>	<b>Violet</b>	<b>Klaus</b>	<b>Sunny</b>
Mansion	1,000,000	950,000	700,000
Luxury car	700,000	750,000	600,000
Family business	2,000,000	3,000,000	1,500,000

Use the Knaster inheritance procedure to divide these assets fairly.