

## Quiz 15

1. Hangry thru-hikers Anuj, Becca, and Crash (he's from Cali it's not his fault) are sharing two high quality granolas - Kashi and Galaxy. Their values for the types of granola are on the left below. Anuj makes the cut on the right, which is a good cut for  $A$  to play Steinhaus' lone divider method.

|     |      |     |
|-----|------|-----|
|     | Kash | Gal |
| $A$ | 1/2  | 1/2 |
| $B$ | 1/3  | 2/3 |
| $C$ | 1    | 0   |

|      |       |       |       |
|------|-------|-------|-------|
|      | $S_1$ | $S_2$ | $S_3$ |
| Kash | 1/3   | 1/6   | 1/2   |
| Gal  | 1/3   | 1/2   | 1/6   |

With this cut above on the right,  $A, B,$  and  $C$  will play Steinhaus' lone divider method.

- (a) Fill out the envy-table below for this example and the Bid lists. How does each player feel about each slice? Which pieces will each player include in their Bid list? (5 pts)

|     |       |       |       |                 |
|-----|-------|-------|-------|-----------------|
|     | $S_1$ | $S_2$ | $S_3$ | Bid list        |
| $A$ | 1/3   | 1/3   | 1/3   | $S_1, S_2, S_3$ |
| $B$ | 1/3   | 7/18  | 5/18  | $S_1, S_2$      |
| $C$ | 1/3   | 1/6   | 1/2   | $S_1, S_3$      |

- (b) Is there an envy-free division which can result from Steinhaus' method in this example?  
 Circle One:  Yes      No (1 pt)

If yes, describe who gets which slice. If no, explain why. (1 pt)

Give  $S_1$  to  $A$ ,  $S_2$  to  $B$ , and  $S_3$  to  $C$ .

- (c) Describe a fair division which is NOT envy-free that results from Steinhaus' method in this example. (1 pt)

There are a lot of different divisions which could result from Steinhaus' method in this example. The one given above is the only one which is envy-free. The following alternatives are fair but not envy-free. Remember by definition of Steinhaus' method, every result must be fair.

- $S_1$  to  $B$ ,  $S_3$  to  $C$ ,  $S_2$  to  $A$  -  $B$  envies  $A$ .
- $S_1$  to  $C$ ,  $S_2$  to  $B$ ,  $S_3$  to  $A$  -  $C$  envies  $A$ .

2. Circle T if the claim is true, F if the claim is false. (1 pt each)

- (a) Every player considers at least one of the slices fair in Steinhaus' lone divider Method.  T       F

- (b) Steinhaus' lone divider method is pareto-optimal. T       F

(a) Exercise 17.4 (Solution)

(b) Example on this quiz, or your example from Exercise 17.6 (Solution)