Chapter 4 Section 3

MA1020 Quantitative Literacy

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Envy

Definition

A division is considered envy-free if each of the n players feels that he or she has received at least $\frac{1}{n}$ of the total value and that no other player has a share more valuable than his or her own.

Continuous Envy-Free Division Method for Three Players – Part 1

1. Player A divides the item into three pieces that he or she considers to be of equal value.
2. Player B evaluates the pieces and determines the most valuable of the three pieces. **(We will assume player B finds only one such piece.)**
3. Player B trims the most valuable piece so that it is value equals the value of the second-most-valuable piece. The piece that was trimmed off is set aside.
4. Player C chooses the piece he or she considers to have the greatest value.
5. Player B gets the piece that was trimmed if it is available. Otherwise, player B gets any other piece he or she considers to have the greatest value.
6. Player A gets the remaining piece.

Continuous Envy-Free Division Method for Three Players – Part 2

1. Of Players B and C, the player who received the trimmed piece will become the second chooser. The other becomes the second divider.
2. The second divider divides the excess into three pieces of equal value.
3. The second chooser selects the piece of the excess that he or she considers to have the greatest value.
4. Player A chooses the piece from the remaining pieces of the excess that he or shee considers to have the greatest value.
5. The second divider gets the last remaining piece of the excess.