

- I. Mike and Phil are roommates and have had serious disagreements about the state of their room. They made a list of the issues they disagree on and decided to use the Adjusted Winner method to resolve their disputes. They each assigned their 100 points to how important it is to them to have control over the following:

	Mike	Phil
a. music volume	18	(22)
b. choice of decorations	18	(20)
c. room party policy	(30)	25
d. cleanliness	(6)	3
e. thermostat setting	14	(15)
f. lights-out time	(4)	2
g. visitor policy	10	(13)

Show the steps to use the Adjusted Winner Method, and describe the final settlement.

Initially, Mike has 40 and Phil has 70. Phil is the giver.

Point ratios for Phil's items:

$$(a) \frac{22}{18} = 1.22 \quad (b) \frac{20}{18} = 1.11 \quad (e) \frac{15}{14} = 1.07 \quad (g) \frac{13}{10} = 1.3$$

↑
Lowest

Can Phil give all of (e), the thermostat?

If so, Mike would have $40 + 14 = 54$
 Phil would have $70 - 15 = 55$ ← Phil still has more. Yes!

Phil still has more. Next-lowest point ratio is (b), decorations.

This they will share. Let $p = \%$ of (b) Phil keeps.

Transfer equation

$$\begin{aligned} \text{Phil's points} &= \text{Mike's points} \\ \text{Phil's other points} + p(\text{Phil's value of decorations}) &= \text{Mike's current points} + (1-p)(\text{Mike's value of decorations}) \\ 35 + p(20) &= 54 + (1-p)(18) \end{aligned}$$

$$35 + 20p = 54 + 18 - 18p$$

$$35 + 20p = 72 - 18p$$

$$38p = 37$$

$$p = \frac{37}{38} \approx 97.4\%$$

Final settlement

Phil gets (a), (g), and 97.4% of (b).

Mike gets (c), (d), (e), (f), and 2.6% of (b).

3. Calvin and Hobbes have discovered a sunken pirate ship and must divide their loot. They decide to use the adjusted winner method.

	Calvin	Hobbes
a. cannon	10	5
b. anchor	10	20
c. unopened chest	15	20
d. doubloon transfer	11	14
e. figurehead	20	30
f. sword	15	6
g. cannonball	5	1
h. wooden leg	2	1
i. flag	10	2
j. crow's nest	2	1
TOTAL	100	100

Initially, Calvin has 44
Hobbes has 84.

Hobbes is the giver.

Point Ratio for Hobbes' items:

(b) $\frac{20}{10} = 2$ (c) $\frac{20}{15} = 1.33$ (d) $\frac{14}{11} = 1.2727$ (e) $\frac{30}{20} = 1.5$

Can Hobbes give entire doubloon? New points: 44 + 11 = 55 Calvin
Yes. 84 - 14 = 70 Hobbes
Still giver.

Next item: (c) chest. entire chest? New pts: 55 + 15 = 70 Calvin
NO. 70 - 20 = 50 Hobbes.

Let p be the % of chest Hobbes keeps.

$$\begin{aligned} \text{Hobbes pts} &= \text{Calvin's pts} \\ \text{H's other pts} + p(\text{H's chest}) &= \text{C's pts} + (1-p)\text{C's chest} \end{aligned}$$

$$50 + p(20) = 55 + (1-p)(15)$$

$$50 + 20p = 55 + 15 - 15p$$

$$50 + 20p = 70 - 15p$$

$$-50 + 15p \quad -50 + 15p$$

$$35p = 20 \quad p = \frac{20}{35} \approx 57.1\% \quad 1-p = 42.9\%$$

Final settlement:

[Calvin gets cannon, doubloon, sword, cannonball, wooden leg, flag, crow's nest, and 42.9% of unopened chest.

[Hobbes gets anchor, figurehead, and 57.1% of unopened chest.