

N-Q Giving raises

Alignments to Content Standards: N-Q.A.2 N-Q.A

Task

A small company wants to give raises to their 5 employees. They have \$10,000 available to distribute. Imagine you are in charge of deciding how the raises should be determined.

- What are some variables you should consider?
- Describe mathematically different methods to distribute the raises.
- What information do you need to compute the raises for each employee?
- Make up the information you need to compute specific raises for 2 different methods and apply them to the situation. Compute the specific dollar amount each employee receives as a raise.
- Choose one of your methods that you think is most fair and construct an argument that supports your decision.

IM Commentary

This is foremost a mathematical modeling task. The task very specifically asks to discuss the variables that could be important in finding a mathematical method for determining raises. This step is often neglected in textbook problems but it is not easy and not at all obvious to students.

There are many factors that go into giving raises: Does everybody get the same raise or do different people get different raises? And if everybody gets the same raise, what

does that mean? Do they get the same dollar amount or do they all get the same percent raise?

The matter of fairness will certainly come up in this task. But what does that mean? New questions may come up: Does every employee work full time or do some of them work part time?

The instructor may choose to have students ask for information and then supply this information. For example: Students may ask for the salary of each employee and if they are full time or part time (whatever that may mean). Employees might have different education (HS, college, post-graduate degree) and they may have different seniority.

[Edit this solution](#)

Solution

a. Some variables to consider are:

- What is the salary of each employee?
- How many hours a week do they work? Are they full time or part time?
- What is their education?
- What is their position? (clerical staff, manager etc.)
- How long have they been working at the company?

b. There are many different methods.

- Method 1: Each person gets the same raise.
- Method 2: Each person gets the same percent raise based on their salary.
- Method 3: This is a slight variation on Method 1 - If some employees are part time and others are full time, every person gets the same raise per hour of work. For example, if one person works 40 hours and another person works 20 hours, then the first person gets twice as much money as the second person.

c. For each method we need different information.

- For Method 1 we don't need any additional information. Each person gets a \$2000 raise.
- For Method 2 we need to know the salary of each employee. Then we can figure out what percent increase will result in a total \$10,000.
- For Method 3 we need to know how much each person is working. Then we can figure out what the raise per hour will be and compute the final raises.

d. We already computed the raises for

- Method 1: Everybody gets $\$10,000/5 = \2000 .
- Method 3 is a slight variation of this. Assume three employees work 40 hours per week, one works 20 hours per week and the last one works 15 hours per week. Then the total number of hours per week is

$$3 \cdot 40 + 20 + 15 = 155.$$

Assuming that the company gives everybody 4 weeks of vacation the total number of work hours per year is

$$155 \cdot 48 = 7440.$$

So the \$10,000 available for raises comes to

$$\$10,000/7440 \text{ hours} \approx \$1.34 \text{ per hour.}$$

So if you work 40 hours per week for 48 weeks, your raise is $40 \cdot 48 \cdot \$1.34 = \2572.8 .

If you work 20 hours per week for 48 weeks, your raise is $20 \cdot 48 \cdot \$1.34 = \1286.4 .

And if you work 15 hours per week for 48 weeks, your raise is $15 \cdot 48 \cdot \$1.34 = \964.8

- Method 2: This is probably the most mathematically sophisticated method. We first need to know everybody's salary. Supposed the salaries are \$70,000, \$50,000, \$50,000, \$35,000, \$30,000. If we want to give everybody the same percent raise, we are looking for a number r , such that

$$(\$70,000 + \$50,000 + \$50,000 + \$35,000 + \$30,000) \cdot r = \$10,000.$$

The sum of all the salaries is \$235,000. Therefore, we need to solve

$$\$235,000r = \$10,000$$

for r , which gives $r \approx 0.043$. So everybody will get about a 4.3% raise. The new salaries after the raises will be \$73,010, \$52,150, \$52,150, \$36,505, and \$31,290.

- The answer here depends on your definition of fairness. In method 2 everybody gets the same percent raise. So if you have a high salary, you get a larger pay raise than if you have a lower salary. This is probably the method used most commonly.

If your goal is to support lower paid employees, then method 3 is designed to accomplish this. Here the raise rewards number of hours worked and it does not depend on your salary at all. So lower paid employees receive a larger percent raise than higher paid employees.

Method 1 is probably the least fair by most definitions, since no matter how much you work, you receive the same raise. A person working few hours or earning a smaller

salary would receive a much higher percent raise than a person working many hours or earning a higher salary.



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