

Appendix B

Examples of Pairs of Training Problems, Their Equations, The Alignment of Their Givens and Unknowns, The Alignment of Their Initial and Final Elements, and an Example of a Participant's Similarity Judgment

A = Amount. In these problems the amounts can be amounts of mixtures or amounts of time. The amounts always serve as the weights in the formula.

R = Ratio. In these problems the ratios can be percentages that indicate the concentration of some substance in the mixtures, or they can be speeds.

Subscripts: 1 and 2 indicate the two initial amounts or their associated ratios. C indicates the combined amount or the ratio associated with it.

General equation for weighted averaging:

$$A_1 * R_1 + A_2 * R_2 = (A_1 + A_2) * R_C \quad (1)$$

Pair 1: Training Problems That Have the Same Solution Procedure Along With Their Equations

Problem A: Mixture problem - Goal: Find combined ratio. A grocery store sells rice that is a mixture of white rice and brown rice. They have 150 lbs. of mixed rice that is 60% brown rice (in other words a proportion of .60). If they combine it with 100 lbs. of mixed rice that is 10% brown rice (a proportion of .10), then what is the resulting percentage (that is, proportion times 100) of brown rice in the whole 250 lbs. of mixed rice?

$$150 * .60 + 100 * .10 = (150 + 100) * X \quad (2)$$

Problem B: Distance problem - Goal: Find combined ratio. Two airplanes leave from the same city at the same time heading for the same destination. The first airplane flies for 2 hours at 150 mph. Then it encounters engine trouble and slows down to 100 mph. It flies for 8 more hours at 100 mph. The second airplane arrived at the destination at the same time as the first plane, but it flew at the same speed for the full 10 hours. How fast was the second airplane flying?

$$2 * 150 + 8 * 100 = (2 + 8) * X \quad (3)$$

Alignment of Givens and

Unknown:

Step 1:

$$\begin{array}{r} 150 \text{ lbs.} \\ \times .60 \\ \hline 90 \text{ lbs.} \end{array}$$

$$\begin{array}{r} 100 \text{ lbs.} \\ \times .10 \\ \hline 10 \text{ lbs.} \end{array}$$

Step 2:

$$\begin{array}{r} 90 \text{ lbs.} \\ + 10 \text{ lbs.} \\ \hline 100 \text{ lbs.} \end{array}$$

Step 3:

$$\begin{array}{r} \underline{100 \text{ lbs.}} \\ 250 \text{ lbs.} \\ || \\ .40 \text{ or } 40\% \end{array}$$

Step 1:

$$\begin{array}{r} 2 \text{ hrs.} \\ \times 150 \text{ mph} \\ \hline 300 \text{ miles} \end{array}$$

$$\begin{array}{r} 8 \text{ hrs.} \\ \times 100 \text{ mph} \\ \hline 800 \text{ miles} \end{array}$$

Step 2:

$$\begin{array}{r} 300 \text{ miles} \\ + 800 \text{ miles} \\ \hline 1100 \text{ miles} \end{array}$$

Step 3:

$$\begin{array}{r} \underline{1100 \text{ miles}} \\ 10 \text{ hours} \\ || \\ 110 \text{ mph} \end{array}$$

Alignment of

Initial and Final

Elements:

150 lbs. --- 2 hrs.
60% ---- 150 mph
90 lbs. -- 300 miles

100 lbs. --- 8 hrs.
10% ---- 100 mph
10 lbs. -- 800 miles

90 lbs. -- 300 miles
10 lbs. -- 800 miles
100 lbs. -- 1100 mi.

100 lbs. -- 1100 mi.
250 lbs. -- 10 hours
40% ---- 110 mph

Example of a Participant's Similarity Judgment:

Same. Both problems give us an initial rates (sic) and want to know the final result.

- a) % of final mixture
- b) final speed.

*Pair 2: Training Problems That Have Different Solution**Procedures Along With Their Equations*

Problem A: Mixture problem - Goal: Find combined ratio. A dairy farmer mixed 1 quart of milk that was 2 % fat (in other words a proportion of .02) with 3 quarts of milk that was 5% fat (a proportion of .05). What was the percentage (that is, proportion times 100) of fat in the whole 4 quarts of milk?

$$1 * .02 + 3 * .05 = (1 + 3) * X \quad (4)$$

Problem B: Distance problem - Goal: Find initial ratio. A college student, Bill, and his girl friend, Hillary, attend two different colleges. They have agreed to meet at a location that is exactly half way between them. Bill and Hillary began driving to the meeting place at exactly the same time. Hillary, who always drives at 75 mph. will arrive in 8 hrs. Bill begins by traveling at 80 mph for the first 6 hrs., but he needs to slow down for the last 2 hrs. of the trip because he wants to arrive at the same time as Hillary. At what speed should Bill drive for the last 2 hours?

$$6 * 80 + 2 * X = (6 + 2) * 75 \quad (5)$$

Alignment of Givens and

Unknown:

Step 1:

$$\begin{array}{r} 3 \text{ qts.} \\ \underline{\times .05} \\ .15 \text{ qts.} \end{array}$$

$$\begin{array}{r} 1 \text{ qt.} \\ \underline{\times .02} \\ .02 \text{ qts.} \end{array}$$

Step 2:

$$\begin{array}{r} .15 \text{ qts.} \\ \underline{+ .02 \text{ qts.}} \\ .17 \text{ qts.} \end{array}$$

Step 3:

$$\begin{array}{r} \underline{.17 \text{ qts.}} \\ 4 \text{ qts.} \\ || \\ .0425 \text{ or } 4.25\% \end{array}$$

Step 1:

$$\begin{array}{r} 6 \text{ hrs.} \\ \underline{\times 80 \text{ mph}} \\ 480 \text{ miles} \end{array}$$

$$\begin{array}{r} 8 \text{ hrs.} \\ \underline{\times 75 \text{ mph}} \\ 600 \text{ miles} \end{array}$$

Step 2:

$$\begin{array}{r} 600 \text{ miles} \\ \underline{- 480 \text{ miles}} \\ 120 \text{ miles} \end{array}$$

Step 3:

$$\begin{array}{r} \underline{120 \text{ miles}} \\ 2 \text{ hours} \\ || \\ 60 \text{ mph} \end{array}$$

Alignment of

Initial and Final

Elements:

$$\begin{array}{r} 3 \text{ qts.} \text{ ---- } 6 \text{ hrs.} \\ 5\% \text{ ---- } 80 \text{ mph} \\ .15 \text{ qts.} \text{ -- } 480 \text{ miles} \end{array}$$

$$\begin{array}{r} 1 \text{ qt.} \text{ ---- } 2 \text{ hrs.} \\ 2\% \text{ ---- } 60 \text{ mph} \\ .02 \text{ qts.} \text{ --- } 120 \text{ mi.} \end{array}$$

$$\begin{array}{r} .15 \text{ qts.} \text{ -- } 480 \text{ mi.} \\ .02 \text{ qts.} \text{ -- } 120 \text{ mi.} \\ .17 \text{ qts.} \text{ -- } 600 \text{ mi.} \\ .17 \text{ qts.} \text{ --- } 600 \text{ mi.} \end{array}$$

$$\begin{array}{r} 4 \text{ qts.} \text{ --- } 8 \text{ hours} \\ 4.25\% \text{ ---- } 75 \text{ mph} \end{array}$$

Example of a Participant's Similarity Judgment:

different. Here first problem wants to find the final % of fat in the mixture (all initials given). In the second problem we need to find an initial value.