

Providing Personalized Guidance in Arithmetic Problem Solving

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Presentation Structure

- Background
 - Solution schemes and paths
- Adapted Feedback
- Implementation issues
- Discussion

Solution Scheme

- Set of quantities (known and unknown) and relations that allow to work out the solution to a given problem
- Solutions that involve the same relations and quantities (independent of the order they are applied) correspond to the same solution scheme

Solution Scheme example

A basket contains 60 pieces of fruit, between apples and pears. It has 10 more apples than pears. How many apples are there in the basket?

Half the number of pieces = Total number of pieces / 2

Half the extra number of apples = Extra number of apples / 2

Number of apples = Half the number of pieces + Half the extra number of apples

Twice the number of pears = Total number of pieces - Extra number of apples

Number of pears = Twice the number of pears / 2

Number of apples = Number of pears + Extra number of apples

Twice the number of apples = Total number of pieces + Extra number of apples

Number of apples = Twice the number of apples / 2

Solution Path I

Example: A basket contains 60 pieces of fruit, between apples and pears. It has 10 more apples than pears. How many apples are there in the basket?

60

Half the number of pieces = Total number of pieces / 2

10

Half the extra number of apples = Extra number of apples / 2

Number of apples = Half the number of pieces + Half the extra number of apples

Solution Path I

Example: A basket contains 60 pieces of fruit, between apples and pears. It has 10 more apples than pears. How many apples are there in the basket?

30

60

Half the number of pieces = Total number of pieces / 2

10

Half the extra number of apples = Extra number of apples / 2

30

Number of apples = Half the number of pieces + Half the extra number of apples

Solution Path I

Example: A basket contains 60 pieces of fruit, between apples and pears. It has 10 more apples than pears. How many apples are there in the basket?

30

60

Half the number of pieces = Total number of pieces / 2

5

10

Half the extra number of apples = Extra number of apples / 2

30

5

Number of apples = Half the number of pieces + Half the extra number of apples

Solution Path II

Example: A basket contains 60 pieces of fruit, between apples and pears. It has 10 more apples than pears. How many apples are there in the basket?

60

Half the number of pieces = Total number of pieces / 2

10

Half the extra number of apples = Extra number of apples / 2

Number of apples = Half the number of pieces + Half the extra number of apples

Solution Path II

Example: A basket contains 60 pieces of fruit, between apples and pears. It has 10 more apples than pears. How many apples are there in the basket?

60

Half the number of pieces = Total number of pieces / 2

5

10

Half the extra number of apples = Extra number of apples / 2

5

Number of apples = Half the number of pieces + Half the extra number of apples

Solution Path II

Example: A basket contains 60 pieces of fruit, between apples and pears. It has 10 more apples than pears. How many apples are there in the basket?

30

60

Half the number of pieces = Total number of pieces / 2

5

10

Half the extra number of apples = Extra number of apples / 2

30

5

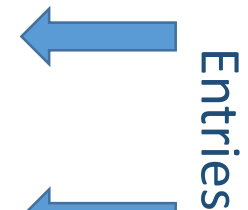
Number of apples = Half the number of pieces + Half the extra number of apples

Resolution paths

Example: A basket contains 60 pieces of fruit, between apples and pears. It has 10 more apples than pears. How many apples are there in the basket?

60

Half the number of pieces = Total number of pieces / 2



10

Half the extra number of apples = Extra number of apples / 2

Number of apples = Half the number of pieces + Half the extra number of apples

Feedback requirements

- Consistent with the resolution path that the student is currently following

60

Half the number of pieces = Total number of pieces / 2

5

10

Half the extra number of apples = Extra number of apples / 2

5

Number of apples = Half the number of pieces + Half the extra number of apples

60

10

Twice the number of pears = Total number of pieces - Extra number of apples



Implementation

- Check if a user input is correct
- Provide adapted/consistent feedback
 - Basic: chose a valid entry
 - More advanced: Chose a valid entry from the most likely hypergraph
 - Even more advanced: Chose the most appropriate entry from the most likely hypergraph, according to the student's profile

Implementation

- Fridman-based representation (hypergraphs)
- XML files

Miguel Arevalillo-Herráez, [David Arnau](#), [Luis Marco-Giménez](#): **Domain-specific knowledge representation and inference engine for an intelligent tutoring system.** [Knowl.-Based Syst. 49](#): 97-105 (2013)

Miguel Arevalillo-Herráez, [David Arnau](#): **A Hypergraph Based Framework for Intelligent Tutoring of Algebraic Reasoning.** [AIED 2013](#): 512-521

Future work

- Future emotional issues

