Übungsblatt 1

zur Vorlesung Elements of Computational and Data Science im SS 2023

Datum der Ausgabe: 04.04.2023 Datum der Abgabe: 11.04.2023

Die mit ★ gekennzeichneten Aufgaben sind für die Prüfungszulassung relevant und unter Angabe von Namen und Matrikelnummer einzureichen.

★ Aufgabe 1 *Strategies to solve problems*

- Use the strategies discussed in the lecture to solve the following problems.
- Complete the list given in Table 1 and state for each example, which strategy you used to solve the problem.
- Be prepared to explain your solution and your chosen strategy.
- Find at least two new interesting problems similar to the given ones and describe them in some short sentences and how you approach their solution.

Example 1 (Butcher)

The butcher is six foot, four inches tall and wears size 14 shoes. What does he weigh?

Example 2 (Revolving coins)

Two 1 Euro coins rest next to each other on a table. One coin is held fixed while the second coin is rolled around the edge of the first coin with no slipping. When the moving coin returns to its original position, how many times has it revolved?

Example 3 (Merkel or Schulz)

If Martin Schulz's rooster laid an egg in Angela Merkel's yard, who owns the egg?

Example 4 (Traffic counter)

A traffic counter registers the event when a pair of wheels on a single axle crosses a certain position of a road. A normal car (with two axles) registers two counts. A light truck (with three axles) registers three counts while a heavy truck registers four. Within a period of one hour, the traffic counter registers 35 counts. How many cars, light truck, and heavy trucks passed over the traffic counter in that hour?

Example 5 (Fathers and sons)

"Brothers and sisters I have none, but that man's father is my fathers's son." Who is *that man*?

Example 6 (Mixed apples)

Three kind of apples are all mixed up in a basket. How many apples must you draw (without looking) from the basket to be sure of getting at least two of one kind?

Example 7 (Socks in the dark)

Suppose you have 40 blue socks and 40 brown socks in a drawer. How many socks must you take from the drawer (without looking) to be sure of getting (i) a pair of the same color, and (ii) a pair with different colors?

© Advanced Computing 2019

Example 8 (Birthday dilemma)

Norman Bates says, “Two days ago I was 20 years old. Later next year I will be 23 years old.” Is this possible. Explain.

Example 9 (Banquet counting)

There were 100 basketball and football players at a sports banquet. Given any two athletes, at least one was a basketball player. If at least one athlete was a football player, how many football players were at the banquet?

Example 10 (A rising tide)

A rope ladder hanging over the side of a boat has rung 20 centimeter apart. Ten rungs are showing. If the tide rises 1 meter, how many rungs will be showing?

Example 11 (Chocolate demographics)

Half of all people are chocolate eaters and half of all people are women. (i) Does it follow that $1/2 \cdot 1/2 = 1/4$ of all people are female chocolate eaters? (ii) Does it follow that half of all men are chocolate eaters?

Example 12 (Two ferry boats)

Two ferry boats ply back and forth across a river with constant speeds, turning at the banks without loss of time. They leave opposite shores at the same instant, meet for the first time 700 feet from one shore, continue on their way to the banks, return and meet for the second time 400 feet from the opposite shore. Determine the width of the river.

Example 13 (Three prisoners)

Three prisoners know that the jailer has three white hats and two red hats. The jailer puts a hat on the head of each prisoner and says,“If you can deduce the color of your own hat, you will be freed.” Each prisoner can see the hats of the other two prisoners but not his own. The first prisoner says, “I cannot tell the color of my hat.” Then the second prisoner says, “I cannot tell the color of my hat.” The third prisoner, who is blind, is able to determine the color of his hat and is freed. What is the color of the third prisoner’s hat, and how did he know?

Example 14 (Driver’s license)

A lady did not have her driver’s license with her when she failed to stop at a stop sign and then went three blocks down a one-way street the wrong way. A policeman saw her, but did not stop her. Explain.

Example 15 (Lost brothers)

I am the brother of the blind fiddler, but brothers I have none. How can this be?

Example 16 (Free fall)

Boris Becker stands on the edge of a cliff 225 m above the sea, practising his serve. He throws the tennis ball upward at a speed of 20 m/s. Irritated by the height of the cliff, he does not succeed in hitting the ball with the racquet. So, the ball falls down to the sea. When does the ball hit the sea?

Example 17 (Marriage)

Is it legal to marry your widow’s sister?

 © Advanced Computing 2019

Example 18 (Apples)

Lisa had 10 apples and ate all but four of them. How many apples were left?

Example 19 (Stamps)

If there are 12 one-cent stamps in a dozen, how many two-cent stamps are there in a dozen?

Example 20 (The second race)

Alice and Bonnie ran a 100-meter race, and Alice beat Bonnie by 5 meters. They decided to race again, with Alice starting 5 meters behind the start line. Assuming that both runners ran the second race at the same pace as in the first race, who won the second race?

Example 21 (Small town haircuts)

A visitor arrived in a small town in need of a hair cut. He discovered that there were exactly two barbers in town. One was well groomed with splendidly cut hair, the other was unkempt with an unattractive haircut. Which barber should the visitor patronize?

Example 22 (Taxi)

A taxi travelled from the hotel to the airport at an average speed of 40 km/h, and the trip took an hour and 20 minutes. It then travelled from the airport back to the hotel and again averaged 40 km/h. This time it took 80 minutes. Explain.

Example 23 (Baseball)

A bat and a ball cost $1.10 in total. The bat costs $1.00 more than the ball. How much does the ball cost?

Example 24 (Machines)

If it takes 5 machines 5 minutes to make 5 widgets, how long would it take 100 machines to make 100 widgets?

Example 25 (Lily pads)

In a lake, there is a patch of lily pads. Every day, the patch doubles in size. If it takes 48 days for the patch to cover the entire lake, how long would it take for the patch to cover half of the lake?

© Advanced Computing 2019

Example	Strategy
1	-
2	-
3	-
4	Formalisieren
5	Visualisieren / Reduction
6	Hypothesis Test / Trial and error
7	Abstraktion / Adaption
8	Visualisierung
9	Formalisieren / Hypothesis Test
10	Lateral Thinking
11	Formalisierung
12	-
13	Lateral Thinking / Root Cause Analysis
14	Lateral Thinking
15	Formalisierung
16	Formalisierung
17	Lateral Thinking
18	Formalisierung
19	Formalisierung
20	Visualisierung
21	Visualisierung
22	Lateral Thinking
23	Formalisierung
24	Reduction
25	Formalisierung

Tabelle 1: Strategies to solve the given problems.

© Advanced Computing 2019