puzzles, riddles and algorithms

# task 1

Bear walks

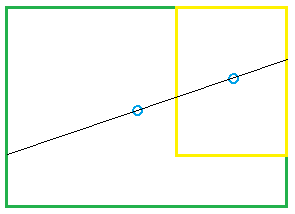
The bear doesn’t return to the left to walk 1 mile to the West. So when it returns the East, something happens that turns the bear (the bear goes to the South and the North which are opposite). It seems like you go and sit into the carousel. So the bear is very close to the some pole of the Earth and when it returns to the East, bear goes around on the center of the Earth.

So it’s the Pole Bear and the color is white. But it also could be any other bear, which was brought from somewhere else. So color could be brown also.

# Task 2

Rectangular

Find the center of the original rectangle. Find the center of the hole. Join them with cut of the knife.



# Task 3

3 baskets with oranges, apples and fruit mix

Take a fruit from the basket with “mix” caption. Since this caption lies and it doesn’t contain mix, you definitely know that this basket contains only this kind of fruits that you’ve just picked.

And now when you know at least one correct caption of the basket, it is not a problem to find two the other ones. So if you picked:

* An apple: the “oranges” basket can’t contain oranges (because caption lies) and apples (because it’s already found). So it contains a mix. The third one has oranges.
* An orange: the “apples” basket has mix and the third one contains apples.

# task 4

8 balls and defect one

After measurement we have 2 cases:

* Balls on the balance have equal weights. This means that defective ball has been measured.
* Balls on the balance don’t have equal weights – some of the measured balls is defective.

So the balance gives us not only information about measured balls, but also about balls, that haven’t been measured yet.

Let’s measure groups of 3 balls:

* If those groups have the same weight – one of 2 unmeasured balls is defective. We can find it after the second measurement of those 2 balls.
* Otherwise defective ball is in the group of 3 balls with less weight. Let’s measure 2 any balls from this group:
  + If the weights are equal – the unmeasured ball is defective.
  + Otherwise defective ball is with less weight.

# Task 5

Manhole cover round

If you use a rectangle, it can fall down inside manhole because the size of some side can be less than diagonal of manhole.

# Task 7

Gold bar and seven days

The main idea is to split bar on parts with suitable number of pieces. The different combinations of those parts give the different total amount of pieces.

We needs parts with 1, 2 and 4 pieces. We can achieve this with 2 breaks of the gold bar.

Days:

1. 1 piece is given to workers.
2. 2 pieces are given to workers. Workers bring back 1 piece.
3. We give 1 piece.
4. We give 4 pieces. Workers bring back 3 pieces.
5. We give 1 piece.
6. We give 2 pieces. Workers bring back 1 piece.
7. We give 1 piece

# Task 8

Los Angeles/New York train

Let’s say the distance between cities is S.

The relative speed of trains (relatively to each other) is 15 + 10 = 35mph.

They’ll collapses at t = S / 35mph.

The distance that bird will have travelled Sb = t \* 25mph = S / 35mph \* 25mph = =

# Task 10

Mirror and reflection

Let’s say light is reflected from your body moves on the mirror. Light is reflected back on you, so you see your right hand, but not reversed left hand. It appears to be left because left and right are relative values for us, but top and bottom – absolute. When we see our reflection in the mirror, left hand of our reflection seems for us right hand, but top and bottom is the same for both.

# Task 11

5 jars of pills

We can take different number of pills from different jars. Let’s take 1 from the first jar, 2 from the second one and so on. Now let’s measure them all together. If all pills had the same weight, total weight is 10 + 20 + … + 50 = 150 gr. But in our case the total weight is lower than this value. If we perform 150 minus current weight, we receive the number of jar with contaminated pills.

# Task 12

Measure exactly 4 quarts of water

1. Fill in 3 quart pail.
2. Fill in 5 from 3.
3. Fill in 3 quart pail.
4. Fill in 5 quart pail from 3 quart pail till the first one is full. In 3 quart pail we have 1 quart.
5. Remove whole water from 5 quart pail.
6. Fill in 5 quart pail from 3 quart pail with 1 quart.
7. Fill in 3 quart pail.
8. Fill in 5 quart pail from 3 quart pail. In 5 quart pail we have 4 quarts.

# Task 13

Unlock car door using key

Key should be turned in opposite way to lock the door.

# Task 16

Helicopter and two trains

It is very complicated to find a condition when the first train move forward, the second backward and they bump. So let’s try to find some way to move 2 trains in one direction but with different speeds. In this case the first one catches up the second one and they bump. The different speeds we can achieve with different number of lines in code.

They both move forward at the very beginning. When the first train finds the parachute of the second one, it have to speed out.

* A: MF
* IF (P)
  + GOTO B
* GOTO A
* B: MF
* GOTO: B

# Task 17

Boat and a suitcase

Let’s consider buoyancy force F = pgV = Fboat + Fsuitcase. From this equation:

* If you throw the suitcase on coast – level of the water decreases

If you throw the suitcase to the water – lever of the water stays the same.

# Task 18

Different ways to implement conditions

* Logical: y = x == 0 ? a : b
* Arithmetical: y = (1 - x) \* a + x \* b;
* Data structure array = new [] { a, b }; y = array[x]

# Task 20

Find a book in a library

Let’s create a recursive algorithm for finding books in the library, if we don’t know how those books are organized beforehand.

Let’s say on the each step of the algorithm we have some atomic elements. Those atomic elements are books at the very beginning. Atomic elements will become sequence of books or sequence of sequences on the next steps of the algorithm.

1. Find by which criteria the neighbor elements are sorted (title, author, publisher, category…)
2. If criteria not found – end
3. Remember this criteria
4. Find all sequences with current criteria
5. All found sequences became atomic elements
6. Repeat step 1

# Task 21

Tradeoff between testing and market

Determine what is the most important and most used for your users – those have to be tested the best. Check if there are some actions, after which your app will be crashed. Check logging modules – you won’t know about errors on your production without this.

If some features aren’t important and won’t be used very often – don’t spend much time to test them.

Concentrate on development. You could lose very expensive time while testing not the major staff. Small bugs can be fixed afterwards, but with each extra testing day you lose your potential clients.

# Task 22

Test for given

If you don’t have much time, you have to test the new functionality, the main functionality (check if it isn’t broken) and if new functionality proper logs errors.

# Task 29

What is a balanced tree?

It’s the tree, where distances from each leaf to the root are the same distance h or h - 1. It’s very important characteristic of trees because speed of searching elements depends on it.

Red Black Tree – subtype of binary tree that is always balanced. Extra actions have to be performed on insert or delete operations to keep tree balanced.

# Task 30

Abstract computer

* dec(a) { result; b = 0; loop(a) { result = b++; } return result; }
* sub(a, b) { loop(b) { a = dec(a); } return a; }
* This one is tricky. Multiply (a, b) = a + a + a + a… b times. So let’s count division with subtraction: a = sub(a, b). We need to count how many times we can perform subtraction until a == 0. Unfortunately we don’t have IF statement. We partially replace IF statement with LOOP statement:

LOOP(0) == IF(false)

LOOP(int) { return int } == IF(true) { return int; }

div(a, b) { c = sub(a, b); loop(c) { return 1 + div(c, b); } loop(a) { d = 0; d++; return d; } return a; }

# task 31

Delete one element from linked list in constant time

You can delete an element from the singly linked list in constant time in case if it is circular list or it doesn’t contain a loop. If a singly linked not circular list contains a loop, there is an element that is referenced by 2 other elements. If you want to delete this element, you have to find proper new reference. Searching for new references doesn’t take constant time.