CS250 Winter 2003

Lecture 1: Introduction to algorithms
Sorted list with $2^{10}$ entries

Comparison of the number of steps necessary for some common operations w.r.t. the choice of data structure.

<table>
<thead>
<tr>
<th></th>
<th>unsorted array</th>
<th>sorted array</th>
<th>tree</th>
</tr>
</thead>
<tbody>
<tr>
<td>add</td>
<td>$1$</td>
<td>$2^{10}$</td>
<td>$10$</td>
</tr>
<tr>
<td>del</td>
<td>$2^{10}$</td>
<td>$2^{10}$</td>
<td>$10$</td>
</tr>
<tr>
<td>search</td>
<td>$2^{10}$</td>
<td>$10$</td>
<td>$10$</td>
</tr>
</tbody>
</table>
Here is one of our favorite “vegetarian dish”.
We always include it to our menu for an indian dinner.

250 gr of chickpeas (1 cup)
2 Tbsp vegetable oil
1 onion chopped
2 cm cinnamon stick
4 cloves
2 garlic cloves, squashed
2 cm fresh ginger, chopped
1 green chili pepper, finely chopped
2 tsp ground coriander
3/4 cup of chopped tomatoes (from a can)
1 tsp garam massala
1 Tbsp cilantro, chopped

Soak chickpeas overnight, rince, cook in water until tender. Drain, KEEP THE COOKING LIQUID!

In a frying pan heat the oil, fry onion until golden. Add cinnamon and cloves, cook a few seconds. Add garlic, ginger, chili pepper, ground coriander and cook 5 minutes, stirring.
Add tomatoes, with the juice and cook until all liquid has evaporated.

Add the chickpeas to the pan, mixe well, cook 5 minutes.
Pour the cooking liquid of the chickpeas and simmer for 25 minutes, until all the liquid is gone.

Sprinkle with the garam massala and cilantro.

Can be served hot or cold.

Serge Demers
Example of algorithm from “The art of war”, by Sun Tzu (Chapter 3)

- Therefore the skillful leader subdues the enemy’s troops without any fighting; he captures their cities without laying siege to them; he overthrows their kingdom without lengthy operations in the field.

- With his forces intact he will dispute the mastery of the Empire, and thus, without losing a man, his triumph will be complete. This is the method of attacking by stratagem.

- It is the rule in war, if our forces are ten to the enemy’s one, to surround him; if five to one, to attack him; if twice as numerous, to divide our army into two.

- If equally matched, we can offer battle; if slightly inferior in numbers, we can avoid the enemy; if quite unequal in every way, we can flee from him.

- Hence, though an obstinate fight may be made by a small force, in the end it must be captured by the larger force.
The Encyclopedia Britannica defines an algorithm as

“A systematic mathematical procedure that produces - in a finite number of steps - the answer to a question or the solution of a problem.”
Hilbert’s 10th problem

“Given a polynomial equation with arbitrary integer coefficients, to find a method to determine, in a finite number of operations, whether the equation is solvable in integer numbers.”

Here we have the requirements of a finite:

- Number of operations
- Number and length of input values
- Solution procedures (each step is carried out by a finite process)
Start with the side with the color you want to be the wings. The other color will be the head and body.

1. Use a 2x1 rectangle with a different color on each side.

2. 2 valley folds to the center

3. Valley fold to the right lining up the crease made in step 2 with the center line.

4. Repeat steps 3 and 4 on the right.

5. Reverse fold in and out on each side.

6. 2 reverse folds

7. Turn over

8. Unfold

9. Fold the point back down while sliding some paper out on each side.

10. Turn over

11. Valley fold the 2 bottom points up so that the dots line up

12. Fold the 2 points up

BUTTERFLY

Valley fold the top like a petal fold.
あきらめないで

作詞・作曲：Blue Sky

Intro.
Am G/A Am G/A Am G/A Am

Vocal

Guitar

A
Am G/A Am G/A Am G/A

みえとプライド おかねばかりが すべてのこのじゃない
public class tester {
    public static void main(String args[]) throws java.io.IOException {
        cube test1 = new cube(0);
        YOUR_METHOD_NAME(test1);
        //replace YOUR_METHOD_NAME by the name of your method

        cube test2 = new cube(2);
        YOUR_METHOD_NAME(test2);
        //replace YOUR_METHOD_NAME by the name of your method

        cube test3 = new cube(4);
        YOUR_METHOD_NAME(test3);
        //replace YOUR_METHOD_NAME by the name of your method
    }
}

...
Computer Science is the study of algorithms for computing machines.

What distinguishes algorithms for computers?

- Instruction are executed VERY quickly
- Little or no human interaction is possible
- Algorithm must be fully specified before execution
- Algorithm must be unambiguously specified

Definition of Algorithm:

A well-ordered collection of unambiguous and effectively computable operations that when executed produces a result in a finite amount of time.
Distance between two nodes of a graph

Breadth first search (BFS): from node 1, check all its neighbours; if node 2 is not found, check the neighbours of the first neighbours; etc.
Further reading

In the book: Introduction of Chapter 3 and Section 3.2.