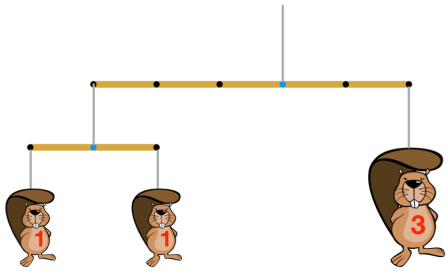
2015-DE-05a

Mobiles

No, this task is not about mobile phones! It is about mobiles, the wonderful artistic objects that might have been hanging from the ceiling of your bedroom when you were a child.

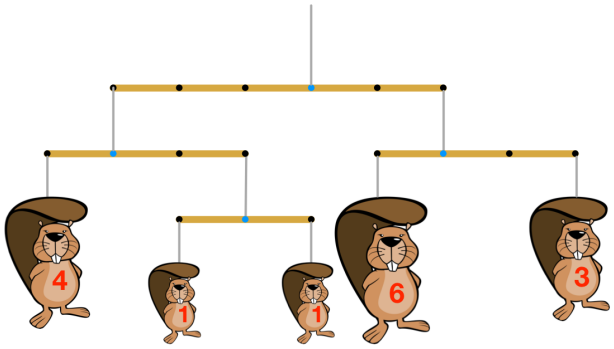
Mobiles consist of sticks and figures. Each stick has a few points where figures or other sticks may be attached to. Also, each stick has a hanging point, from which it is attached to a stick further above (or, in the case of the uppermost stick, directly to the ceiling). Figures carry numbers representing their weight.

The image shows a small sample mobile.



This sample mobile can be fully described using numbers and brackets:
(-3 (-1 1) (1 1)) (2 3)

Now here is another mobile:



How can this mobile be described,
using numbers and brackets in the same way as in the example?

A. (-3 (-1 4) (2 (-1 1) (1 1))) (2 (-1 6) (2 3))
B. (4 (1 1)) (6 3)
C. (((-1 4) -3 ((-1 1) 2 (1 1)))((-1 6) 2 (2 3)))
D. (-3 (-1 4) (2 (-1 1) (1 1) (2 (-1 6) (2 3)

The correct answer is:

A is the correct answer.

From the sample mobile, we can conclude the following about how a mobile is described:
A structure that is hanging from a stick is described by

- an opening bracket;
- the stick position where it is hanging from (with the hanging point of the stick equal to 0);
- the descriptions of its parts; and
- a closing bracket.

Sticks (including the uppermost one) are described by describing the strucures hanging from it.
Figures are described by their weight.

Answer A describes the mobile in question in exactly this way.
Answer B only contains weights, but no positions.
In answer C, the stick positions are given in between the description of parts, not at the beginning.
Answer D lacks closing brackets for sticks.

It's Informatics!

The structure of a mobile has an interesting property: If you deattach a stick (except the uppermost one) from a mobile, you have a mobile again, with the deattached stick being the uppermost stick now. That is, the parts of a mobile are constructed in the same way as the full mobile is constructed. If a single figure is considered as a (very basic) mobile, mobiles may be defined very briefly, as follows: A mobile is (a) either a single figure, or (b) a stick with one or more mobiles attached to it. That is, in order to define a "mobile", we use the term "mobile" itself. In informatics, such structures and their definitions are called *recursive*. With computer programs, recursive data structures may be assembled and processed. Typically, only few code lines are needed to do so, thanks to the brevity of their definitions.

http://en.wikipedia.org/wiki/Alexander_Calder

Attributes

Category: INF
Age Group / Difficulty: TBD
Interactivity: 4-alternatives
colour-blind-proof: yes

Authorship

2015-04-14 Proposal: Wolfgang Pohl (DE)

Wording

A figure / A stick **is attached to** another stick.

uppermost stick: the only stick of a mobile that is not hanging from another stick.

A mobile **can be described** using numbers and brackets.

Comments

2015-04-14 Wolfgang Pohl (DE):
This task has been derived from a problem that was set in the German CS contest "Bundeswettbewerb Informatik" (contest 33, round 1).

Files

2015-DE-05a-eng.html (this file)
2015-DE-05a-eng.pdf (pretty print)
sample-mobile.png
question-mobile.png
mobiles.svg (source for all PNG images listed above)

License
