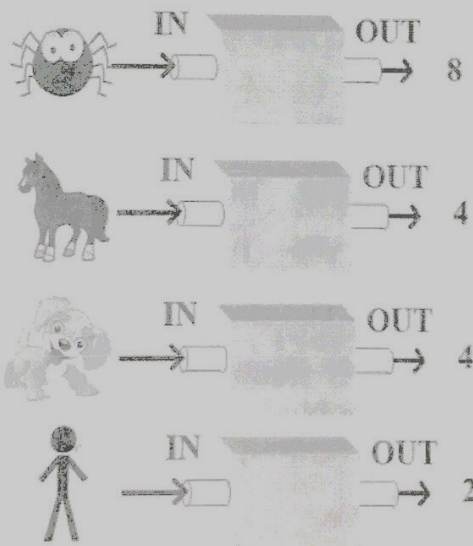# Function Machine

November 5, 2017

November 5th, 2017

1. A function machine takes something called an input, then follows certain rules and produces something new called an output. Below are some of the inputs (on the left) and outputs (on the right) of Katie's function machine.

1. Can you figure out what rule Katie's function machine is following?

The machine takes animals as inputs and outputs the number of legs it has

Every function machine takes its inputs from a bag called the Input bag. Here are some examples of this function machine's Input bag:
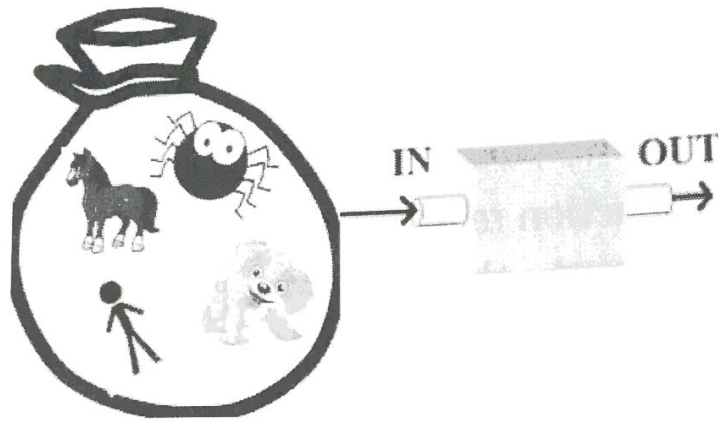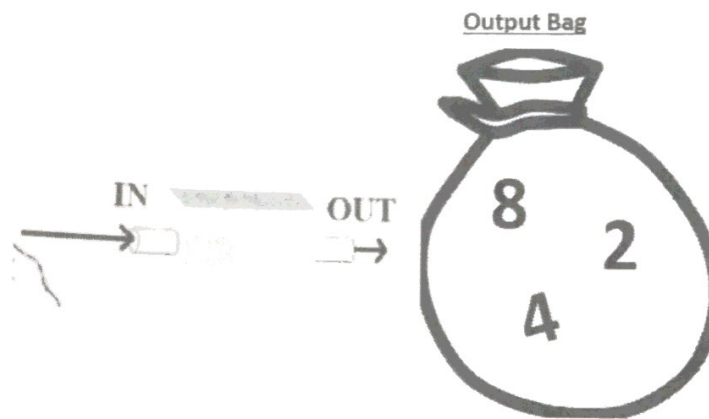

2. In this case, our Input bag is made up of every kind of animal (not just the ones in the picture!). Decide whether the following things could be found in our Input bag:

a. moose   (yes)   no

b. square   yes   (no)

c. tomato   yes   (no)

d. mouse   (yes)   no

3. Give three other examples of things we can put into our function machine:

Rabbit, Lizard, Fish

Every function machine puts its outputs into a bag called the Output bag. Here are some examples of this function machine's Output bag:

Output Bag

IN ⟶ OUT ⟶ (8 2 4)

4. In this case, our Output bag is made up of all numbers. Decide whether the following things could be found in our Output bag:

a. car   yes   (no)

b. 6   (yes)   no

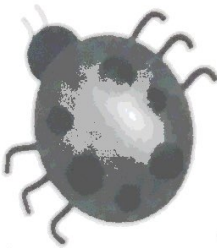c. 100   (yes)   no

d. goose   yes   (no)

5. Give three more examples of what we might find in our Output bag:

7, 42, 33

When Katie's function machine is changing things from its Input bag into things that go into the Output bag, it looks like this:

Input Bag: Animals

Output Bag: Numbers

IN $\longrightarrow$ OUT

$\rightarrow$ 8

2

4
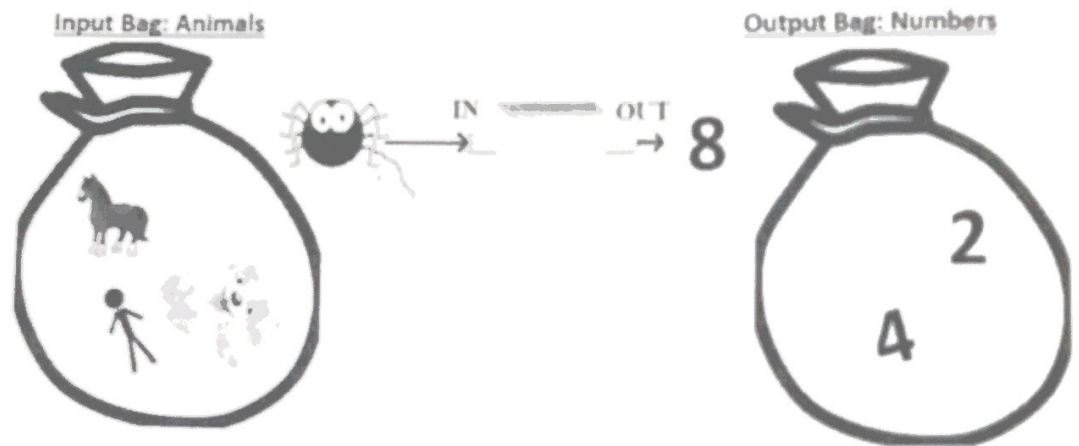
6. Decide what Katie's function machine will do with the following things from the Input bag:

a. $\rightarrow$ 2

b. $\rightarrow$ 6

c. $\rightarrow$ 4

d. $\rightarrow$ 2

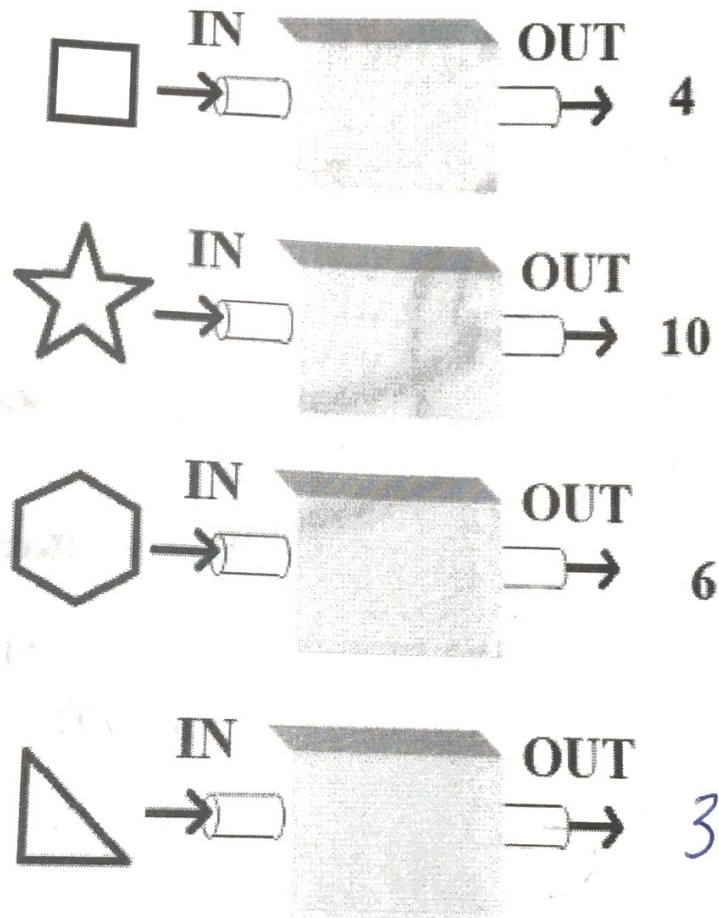Travis really likes Katie's function machine, so he got one too! Here is what Travis' function machine does. Can you fill in the last input for the machine?

IN → OUT → 4

IN → OUT → 10

IN → OUT → 6

IN → OUT → 3

7. What rule is Travis' fucntion machine following?

Travis' function machine takes shapes as inputs and returns the number of sides (or cornerns) as outputs.

8. Fill in some more examples of what the Output bag will look like for this function machine. Make sure to show which inputs go to which outputs.

Input Bag: Animals

Output Bag: Numbers

IN   OUT

→6
→3
4
5
10
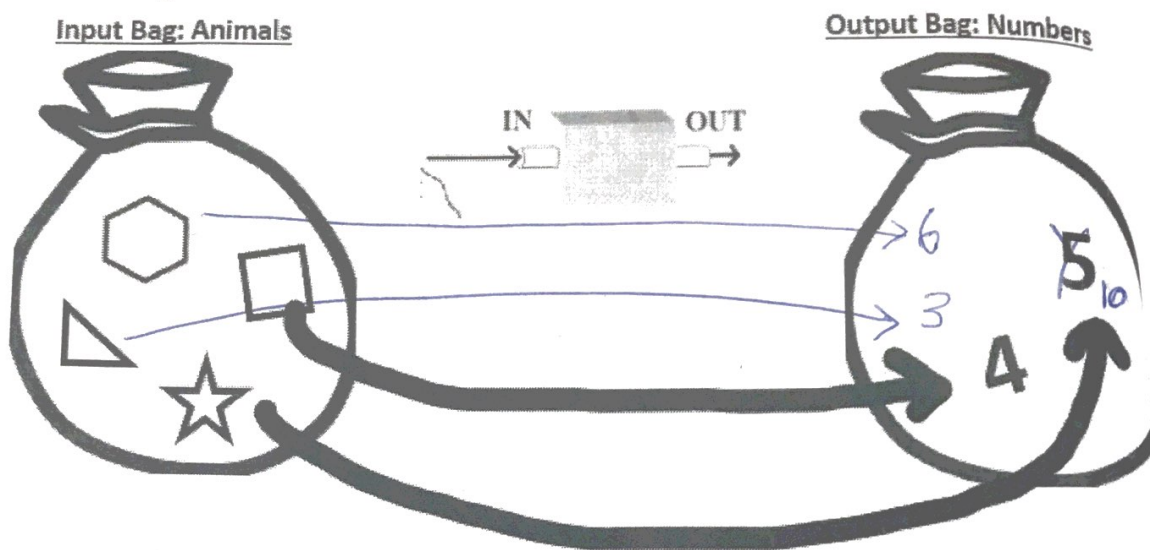
9. What are the type of things we will find in this function machine's Input bag?

Shapes

10. What types of things will we find in its Output bag?

Numbers

Finally, Bonnie has a function machine too!
Here is what Bonnie's function machine does
to its inputs:

IN   OUT

2 → 🔲   🔲 → 6

IN   OUT

1 → 🔲   🔲 → 3

IN   OUT

4 → 🔲   🔲 → 12

IN   OUT

3 → 🔲   🔲 → 9

11. Can you figure out the rule that Bonnie's
function machine is following?

Bonnie's function machine takes in numbers as
inputs and returns 3 times that number as
the output

7

12. Fill in some examples of what the Input and Output bag for this function machine will look like. Make sure to show which inputs go to which outputs.

Input Bag:

IN ☐ OUT

5 → 15
6 → 18
10 → 30
20 → 60
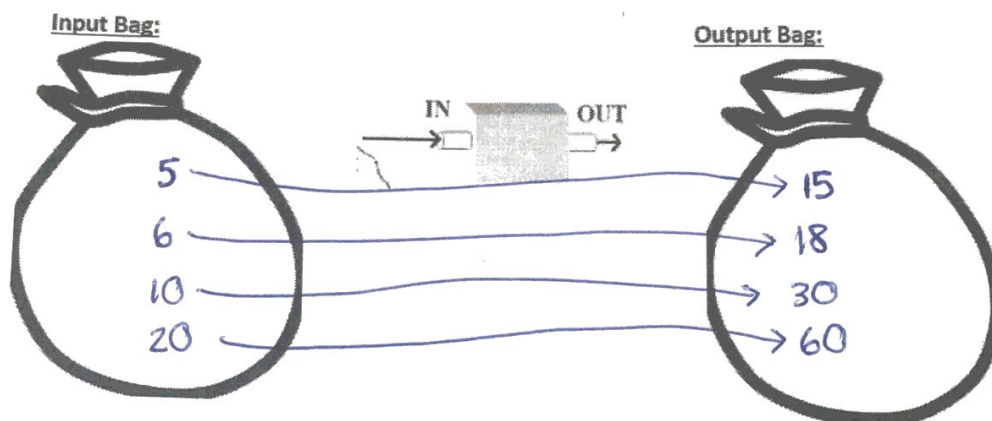
Output Bag:

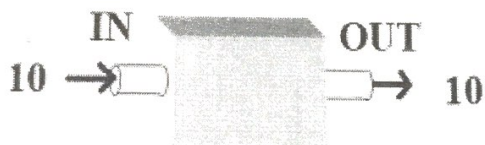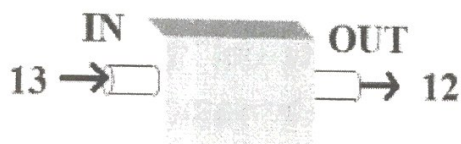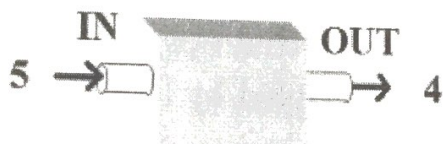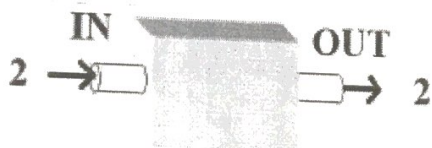13. What are the type of things we will find in this function machine's Input bag?

Numbers

14. What are the type of things we will find in its Output bag?

Numbers

Challenge Function:

1. Can you figure out the rule for this function machine?

IN   OUT
2 →   → 2

IN   OUT
5 →   → 4

IN   OUT
13 →   → 12

IN   OUT
10 →   → 10

IN   OUT
9 →   → 8

IN   OUT
8 →   → 8
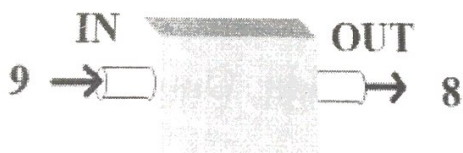
When this function machine takes in even numbers, it returns the same number.
When it takes in odd numbers, it returns that number minus 1. (output = input −1)

11

To make a function machine easier to work with, we want to have a simple way to describe the machine's rule. Here is one way to do it. For Bonnie's function machine we can write:

$$\text{Output} = 3 \times \text{Input}$$

This is telling us that our output will always be our input multipled by 3.

2. Can you write out what our Challenge Function does in the same way that I wrote out what Bonnie's function does? Remember, even and odd inputs follow different rules!

When input is even: Output = Input

When input is odd: Output = Input −1