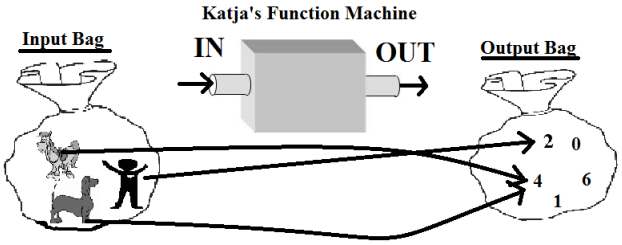
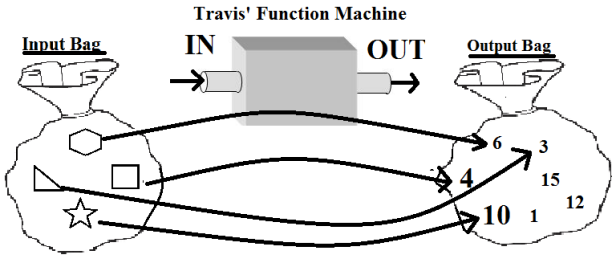
A function machine is called ***one-to-one*** if every one of its inputs goes to a **different** output. Let's determine which of our functions from last week are one-to-one.



1. Is Katja's function machine one-to-one? If not, give an example of two inputs that go to the same output.

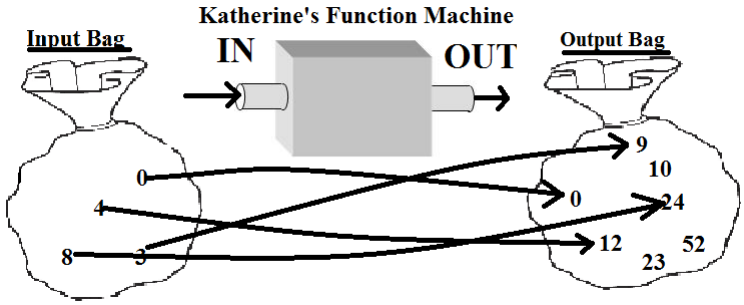
Solution: No it is not. For example, cat and dog both go to the number 4.



2. Is Travis' function machine one-to-one? If not, give an example of two inputs that go to the same output.

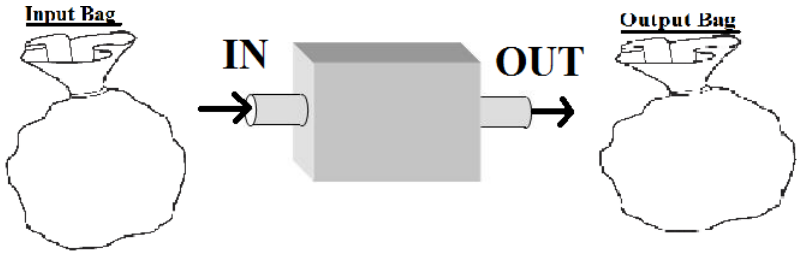
Solution: No it is not, for example, a dia-

mond and a square both go to the number 4.



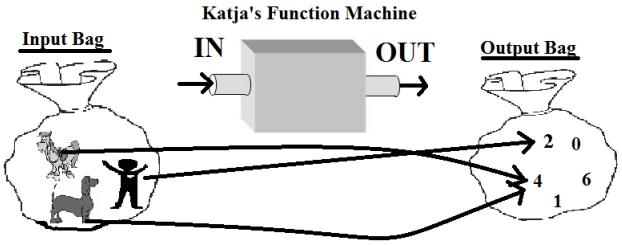
3. Is Katherine's function machine one-to-one? If not, give an example of two inputs that go to the same output.

Solution: Yes it is, every two different inputs go to two different outputs.



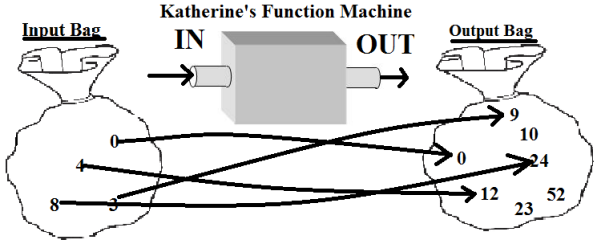
4. Is the function machine you made for homework one-to-one? If not, give an example of two inputs that go to the same output.

Function machines can work one after the other. This can happen when one function's **outputs** can be another function's **inputs.** Let's see when this can happen.



5. What types of things are the **outputs** for Katja's machine?

Solution: Numbers



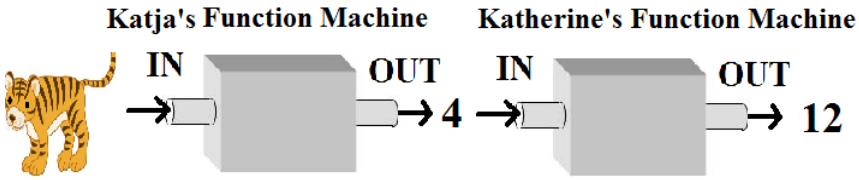
6. What types of things are the **inputs** for Katherine's machine?

Solution: Numbers

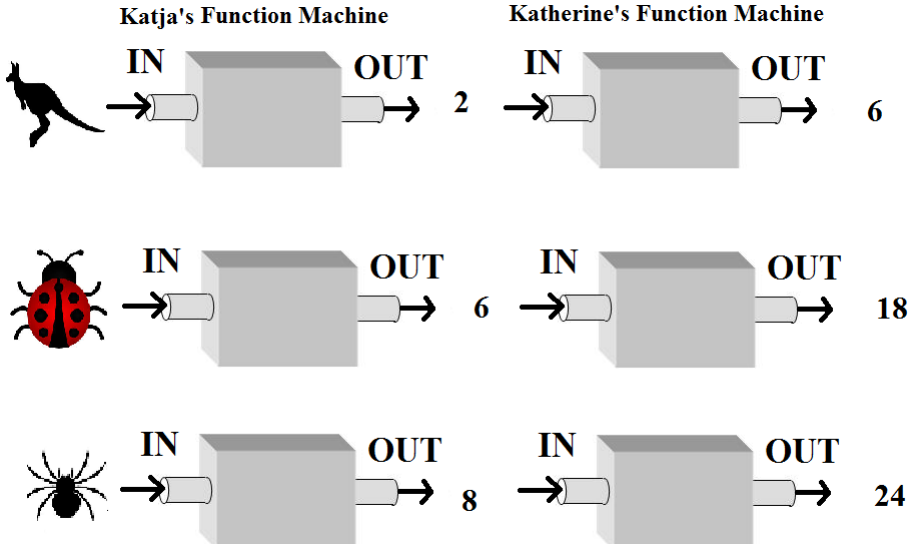
7. Can the outputs of Katja's machine go in Katherine's machine?

Solution: Yes!

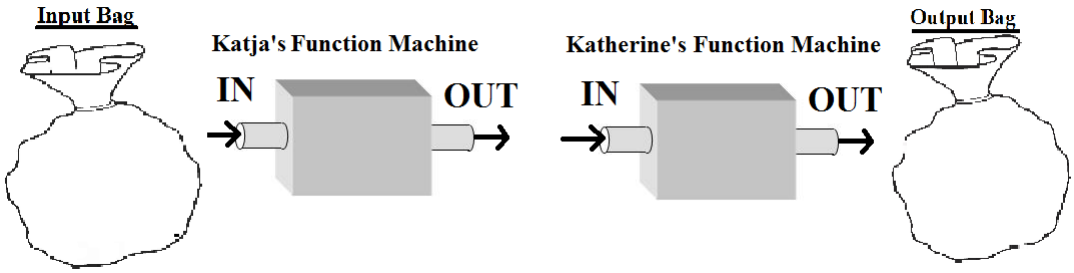
Since the outputs of Katja's machine can go into Katherine's machine, Katherine's machine can work after Katja's machine! Here is what that will look like:



8. What will be the outputs for the following inputs when Katherine's machine works after Katja's?



9. Fill in some examples of what we will find in our Input and Output bags:



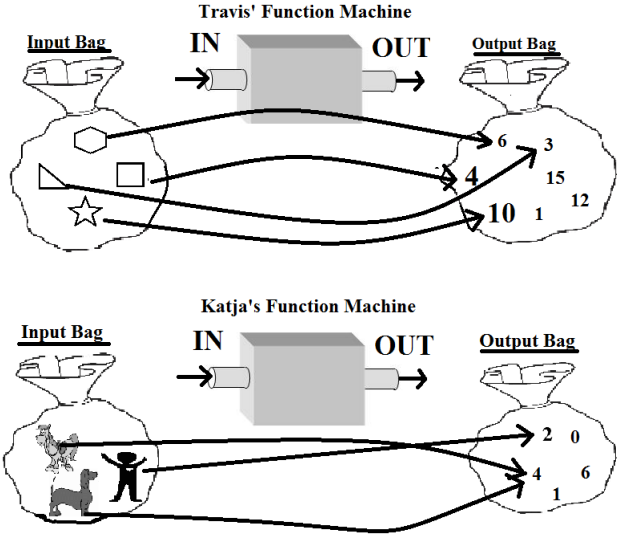
10. What types of things will we find in our Input bag?

Solution: Animals

11. What types of things will we find in our Output bag?

Solution: Numbers

If one machine's outputs can't be found in another machine's Input bag, then the machines will **not** work one after the other.

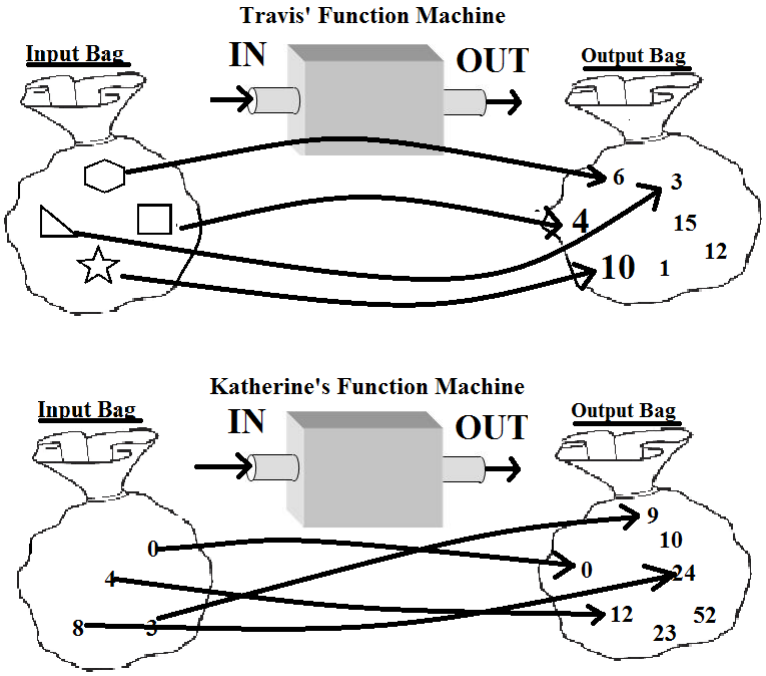


12. Above are Travis' function machine and Katja's function machine. Can Katja's machine work after Travis'? Why or why not?

Solution: No, because Katja's function machine takes in animals as inputs, and Travis' output bag is made up of numbers.

13. Can Travis' machine work after Katja's machine? Why or why not?

Solution: No, because Travis' function machine takes in shapes as inputs, and Katja's output bag is made up of numbers.

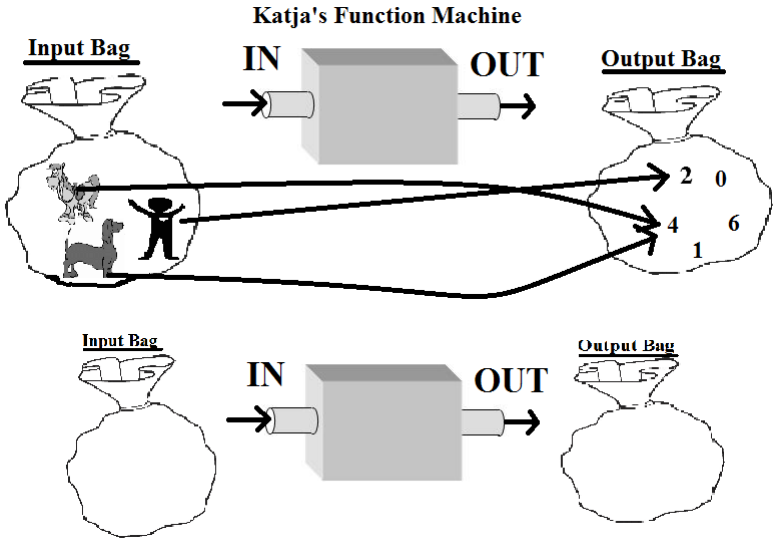


14. Above are Katherine's function machine and Travis' function machine. Can Katherine's machine work after Travis'? Why or why not?

Solution: Yes, since the things in Travis' Ouput bag can be found in Katherine's Input Bag.

15. Can Travis' machine work after Katherine's machine? Why or why not?

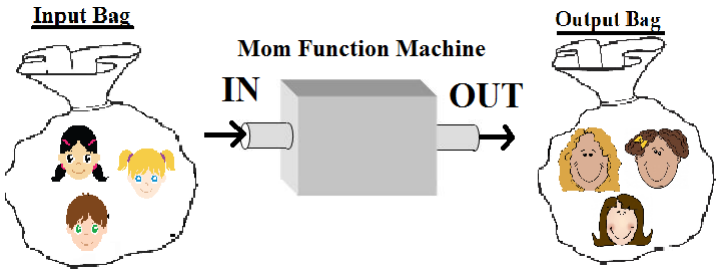
Solution: No, because Travis' function machine takes in shapes as inputs, and Katherine's output bag is made up of numbers.

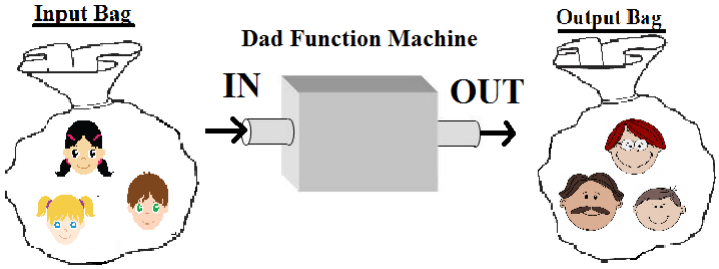


16. Fill in the details for your function machine. Then look at Katja's function machine. Can Katja's machine work after your machine? Why or why not?

16. Can your machine work after Katja's machine? Why or why not?

Challenge Functions.





Above are two new function machines. The first one sends any person from its Input bag to that person's mom. The second one sends any person from it's Input bag to that person's dad.

1. Is the "Mom" function machine a one-to-one function? If not, give an example of when two inputs would go to the same output.

Solution: No, for example, a brother and a sister would both go the same output, their mother.

2. Is the "Dad" function machine a one-to-one function? If not, give an example of when two inputs would go to the same output.
Solution: No, for example, a brother and a sister would both go the same output, their father.

3. Can the "Mom" function machine work after the "Dad" function machine? Why or why not?
Solution: Yes, since the outputs for the "Mom" function machine (people) can be found in the Input bag for the "Dad" function machine.

4. Can the "Dad" function machine work after the "Mom" function machine? Why or why not?
Solution: Yes, since the outputs for the "Dad" function machine (people) can be found in the Input bag for the "Mom" function machine.

6. Tim is a young boy. Can we get to each of Tim's grandmothers by using the function machines? Explain how you would get to each grandmother. (Hint: you can use a function machine more than once)

Solution: To get to his mother's mother: Use the "Mom" function machine twice.

To get to his father's mother: Use the "Mom" function machine, and then the "Dad" function machine.

b. Can we get to Tim's cousin on his father's side by using the function machines? Explain.

Solution: No, since we can only climb up the family tree from Tim, so we can only get to parents of parents, and so on.

c. d. Can we get to all of Tim's great-grandfathers on his father's side by using the function machines? Explain how you would get to each of those great grandfathers.

Solution: Yes. For example, to get to his great grandfathers on his father's side, you would either use the "Dad" function machine three times, or the "Dad" function machine, then the "Mom" function machine, and then the "Dad" function machine once more. Similarly for his great-grandfathers on his mother's side.