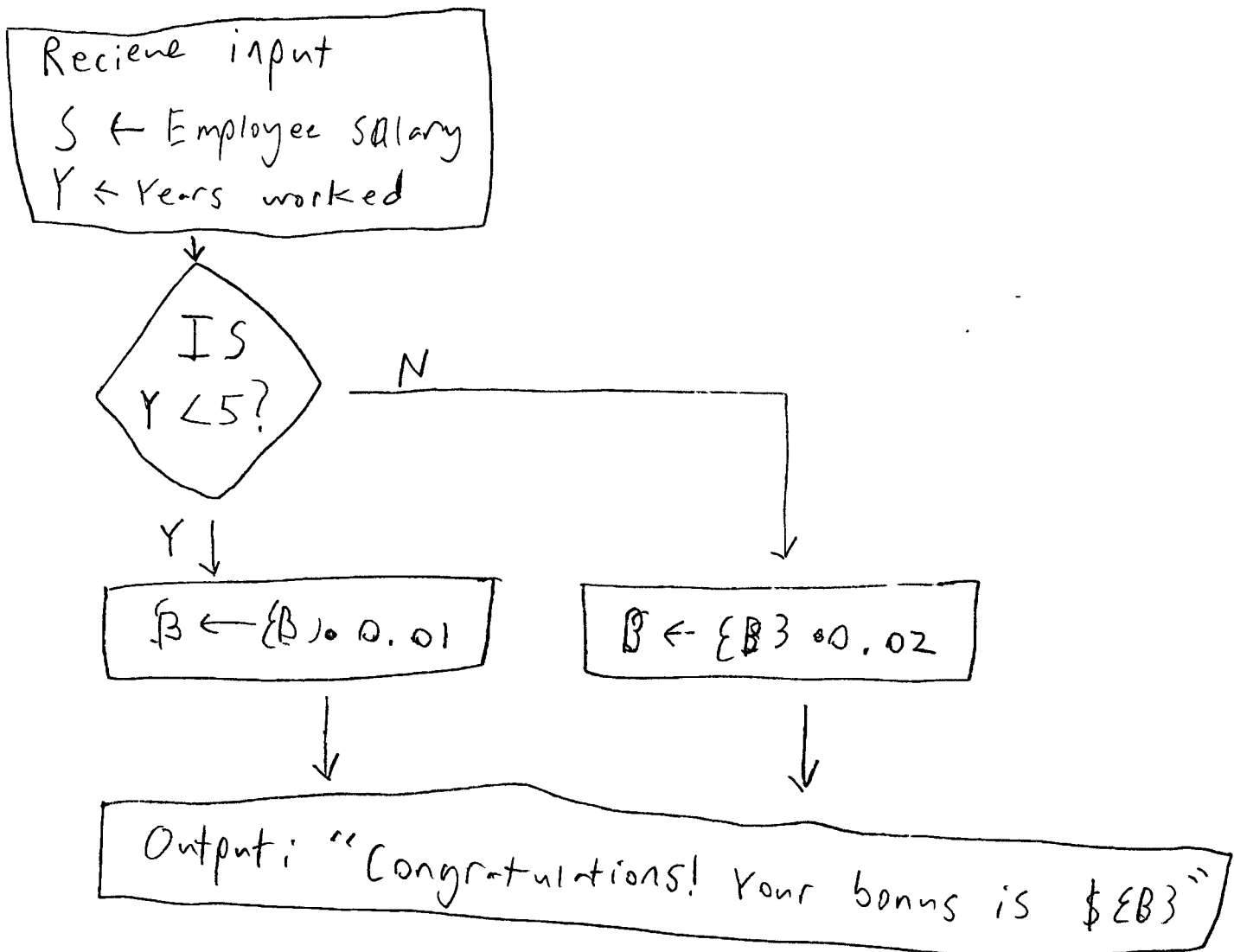Ryan Dodd
CS 101

CS101: Lab #1
Flowcharts and Algorithms

Write a flowchart illuminating each scenario described. State all variables clearly and label specifically any information that is input from the user.

1. Assume a company pays an annual bonus to its employees. The bonus is based on the number of years the employee has been with the company. Employees working at the company for less than 5 years receive a bonus equal to 1% percent of their salary; all others receive a bonus equal to 2% of their salary. Provide a flowchart which shows how an employee's bonus is calculated. Include reading in appropriate data and printing an output message that mimics the format of the following message, where *<bonus-value>* represents the numeric value for the bonus:

    Congratulations! Your bonus is $*<bonus-value>*.

    Don't forget the '$' and the closing period.

Recieve input
S ← Employee salary
Y ← Years worked

IS Y < 5?

N

Y

B ← {B} • 0.01

B ← {B} • 0.02

Output: "Congratulations! Your bonus is ${B}"

2. The following table provides the speed of sound waves in several materials:

| Material	Velocity of Sound
Iron	5950 meters/sec
Polystyrene	2350 meters/sec
Water	1531 meters/sec
Air	$331.5 + 0.6t$ where t is the temperature in degrees Celsius

Draw a flowchart that uses this table to calculate the speed of sound in various materials. More specifically, the algorithm will read in a material value and output the speed of sound in that material. For air calculations, you'll need to read in a second value (temperature in degrees Celsius).
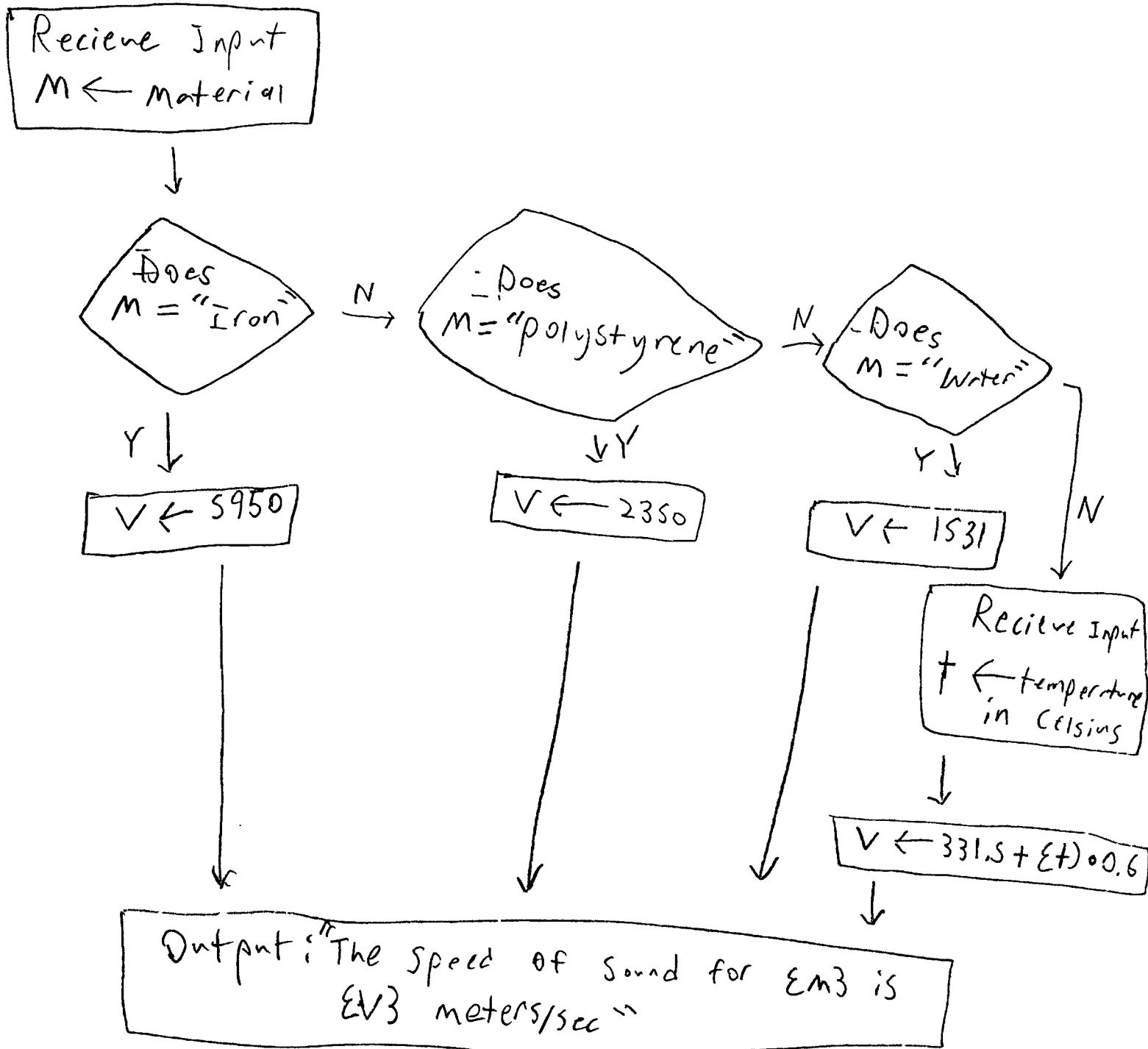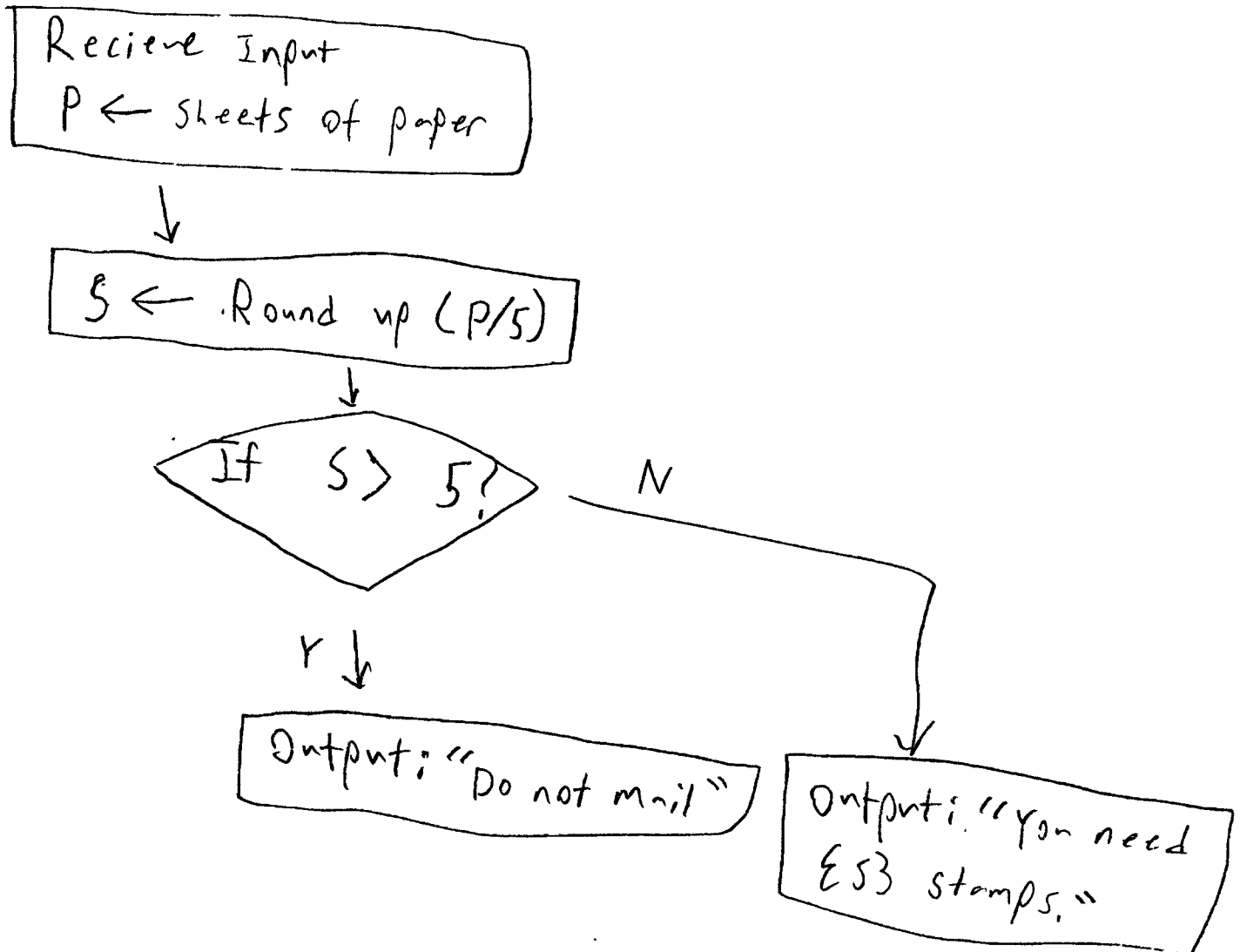
3. The following simple rules describe how to categorize living organisms into one of five kingdoms – Monera, Protoctista, Plantae, Fungi, Animalia.

   a) If the organism has no cell nucleus, then it's in the Monera kingdom (more commonly known as bacteria).
   b) If the organism does not fit into the above category, and it is single celled, then it is in the Protoctista kingdom (molds and algae).
   c) If the organism does not fit into either of the above categories, and it is photosynthetic, then it's in the Plantae kingdom (plants).
   d) If the organism does not fit into any of the above categories, and it has a nervous system, then it is in the Animalia kingdom (animals).
   e) Otherwise, if the organism does not fit into any of the above categories, it is in the Fungi kingdom (fungus).

Construct a flowchart that uses this categorization scheme to determine the kingdom for a particular living organism. You may assume information about an organism can be acquired using functions: hasNucleus(O). Print the organism's kingdom.
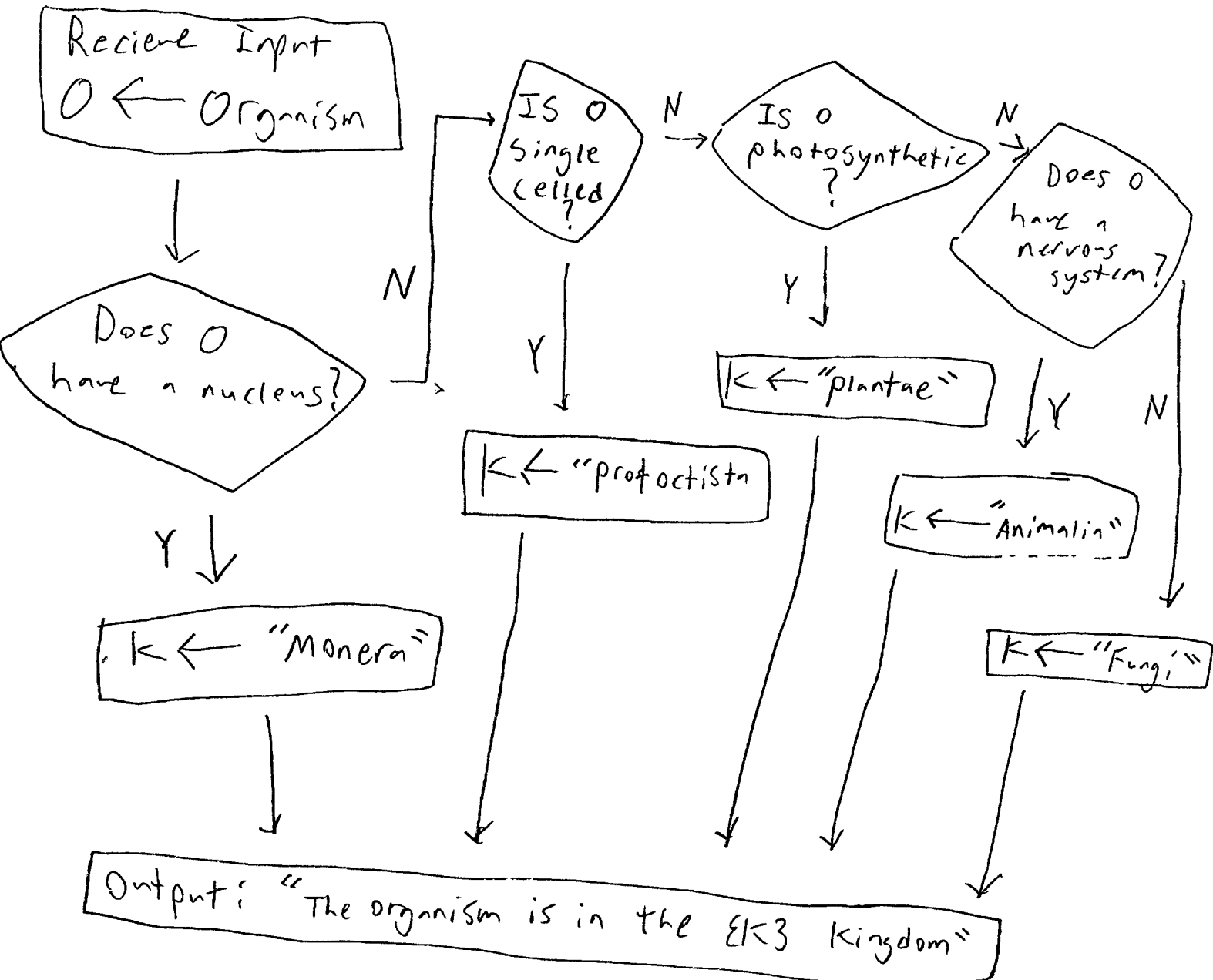
4. When mailing a letter, the amount of postage is in question. You like to use this rule of thumb: use one stamp for every five sheets of paper or fraction thereof. For example, if you have 11 sheets of paper, then you must use three stamps. Since you are frugal, if an envelope requires more than five stamps, then you simply don't mail the envelope. In your flowchart, you must read in appropriate data and print how many stamps to use.

Recieve Input
P ← Sheets of paper

S ← Round up (P/5)

If S > 5?

N

Y

Output: "Do not mail"

Output: "You need {S} stamps."

5. Stock market analysts sometimes characterize stock market growth using the terms *bear, stagnant, bull,* and *boom.* A bear market refers to a market with significant negative growth. A stagnant market refers to a market with little negative or positive growth. A bull market refers to a market with significant positive growth. A boom market refers to a market with very high growth.

Stock market growth varies widely from year to year, and the following table presents evidence of that phenomenon. The table documents annual rate of return statistics for the S&P 500 stock market index during the 40-year period, 1951—1990. The table's first row shows that an annual return rate of less than -10% occurred 10% of the time. The volatility of stock market growth is evidenced by the fact that "stagnant markets" (annual return rates, inclusive of, between -10% and +10%) only occurred 30% of the time.

Market	Range of Return (r)	Probability that Annual Return on Investment Falls within Range r
bear	Less than -10%	10%
stagnant	Between -10% and +10%	30%
bull	Between 10% and +30%	43%
boom	Greater than 30%	17%

Draw a flowchart for an algorithm that uses this table to print the type of market that exists for a given annual return on a stock market index. More specifically, read in an annual return value and print this message:

```
The rate of return is indicative of a _____ market (which occurs _____ of the time).
```

Replace the first blank with one of the four market categories. Replace the second blank with the appropriate value from the table's third column.