Name(s)_____ Period _____ Date _____

Activity Guide - Flowcharts

The Types of Questions You Can Ask a Computer

When we make decisions as humans, we usually consider complex sets of conditions, like the circumstances surrounding the decision, past experience, or even just how we feel. When we want to write programs that make decisions, we need to represent our decisions in a way the computer can understand.

Decision Making with a Computer
- The computer evaluates some statement (also called an expression) that can only be **true** or **false**. This means that the result can be represented by a single bit.
- This result determines which of two parts of the program will run next.

The types of statements that a computer can evaluate as either true or false are also limited by the fact that information stored in the computer is binary. As a result, most true/false statements you will use in your programs are **comparing two values** in the computer's memory. Here are the **most common types of comparisons** you'll see:

__ **is equal to** __   __ **is greater than** __   __ **is greater than or equal to** __

__ **is not equal to** __   __ **is less than** __   __ **is less than or equal to** __

Creating Computer Questions

It can take a little practice to convert a **question** you might ask as a human into a **binary statement** that can be evaluated by a computer. Here are some examples:
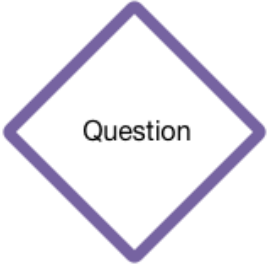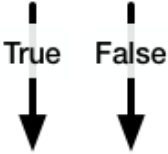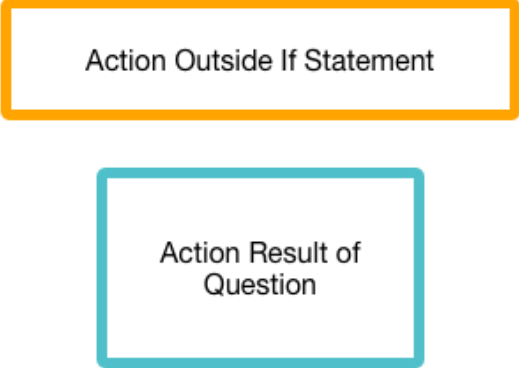
The Human Question	The Computer Question		The Human Question	The Computer Question
Are you old enough to drive?	Is age greater than or equal to 16?		Is it lunch time?	Is the time equal to 12?
Did I fail the test?	Is grade less than 70?		Is it the weekend?	Is the day equal to Saturday? If not, is the day equal to Sunday?
Was it a tied game?	Was the home team score equal to the away team score?		Is this person a teenager?	Is age greater than 12? If yes, is age less than 20?

Your Turn! Change the following human questions into computer questions:

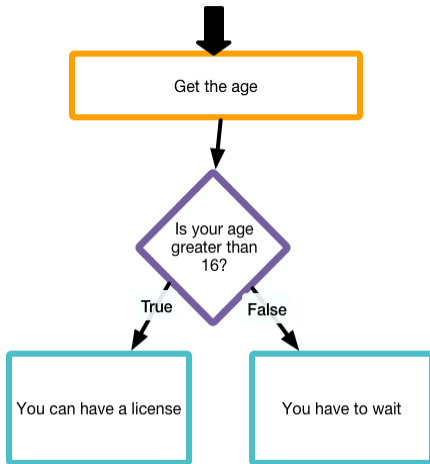| Human Question	Computer Question
Could this water freeze right now?	
Did I get a baker's dozen (13) of donuts?	
Am I old enough to vote?	
Were you born before the millennium?	
Are you an only child?	

Flowchart Components

One way that programmers plan complex programs with decisions in them is to create diagrams called **Flowcharts**, which demonstrate the logic they want for their program. Flowcharts have a couple different components. Each component is a different shape to signify its purpose. Check out the table below as a build to flowcharts.
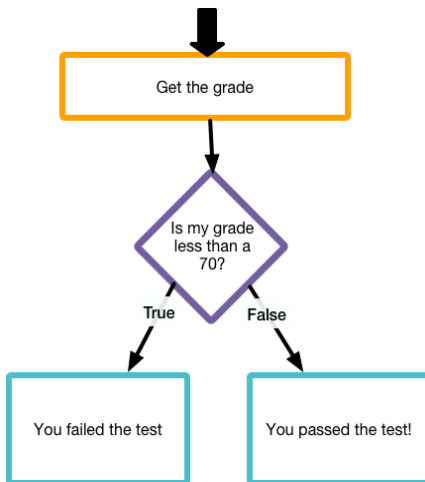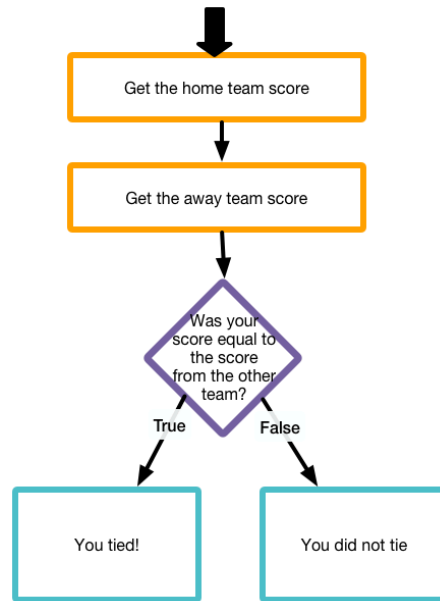
Component	Purpose
Question	A **diamond** represents a decision to be made within your program, based on a binary question or expression (one that has only two possible responses). We will see more about binary questions later in this activity.
True False	**True** and **False arrows** designate the paths taken, based on the result of a decision (diamond). Note once again that every decision may have only 2 possible paths that result from it, one for true and one for false.
Action Outside If Statement Action Result of Question	A **rectangle** represents an action that is performed. Some actions may be performed as the direct result of a decision, while others are performed every time a program is run. The examples we'll see usually use the following style: ● Action that is always performed: wide orange rectangle ● Action performed based on decision: narrow blue rectangle **When you draw your own flowcharts, you may use a single style of rectangle for all actions.**
	A **simple arrow** indicates that we are moving from one action to the next without considering any decision. These will generally be used to link a set of actions to be completed one after the other.

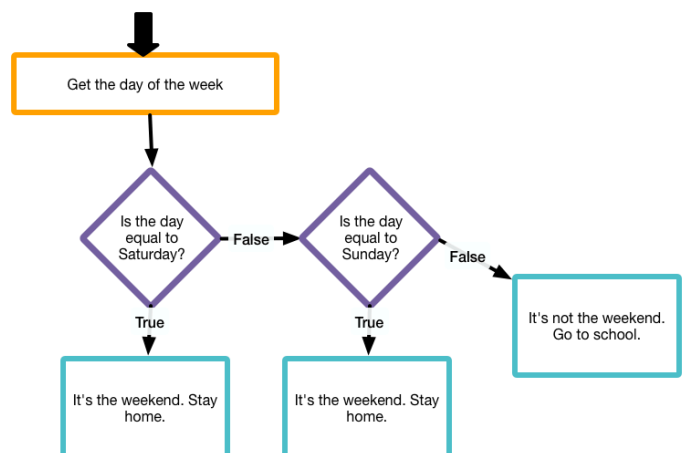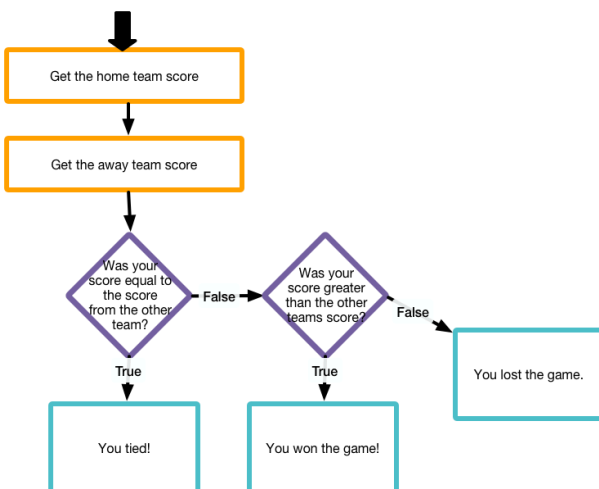# The Results of Questions You Can Ask a Computer

So far we have only created questions, but in order to use them to make decisions, we need to specify actions that get performed depending on the result. Check out the examples of flowcharts below:

Get the age

Is your age greater than 16?

True → You can have a license

False → You have to wait

Get the grade

Is my grade less than a 70?

True → You failed the test

False → You passed the test!

Sometimes you need to get multiple pieces of information to make your decision.

Get the home team score

Get the away team score

Was your score equal to the score from the other team?

True → You tied!

False → You did not tie

Sometimes you want to ask a follow up question to your original question based on a certain answer.

Get the home team score

Get the away team score

Was your score equal to the score from the other team?

False → Was your score greater than the other teams score?

False → You lost the game.

True → You tied!

True → You won the game!

Get the day of the week

Is the day equal to Saturday?

False → Is the day equal to Sunday?

False → It's not the weekend. Go to school.

True → It's the weekend. Stay home.

True → It's the weekend. Stay home.

Your turn!
Refer back to your Human-Computer Questions you worked on before. Can you make flow charts for them? The questions are copied below for your reference.

Human Question	Flow Chart
Could this water freeze right now?	
Did I get a baker's dozen of donuts?	

Human Question	Flow Chart
Am I old enough to vote?	
Were you born before this millennium?	
Are you an only child?	