Decisions

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Key Points

We will learn JavaScript to write instructions for the computer to make decisions based on given data.

The key programming concepts covered:

- decisions and Boolean conditions

Making Decisions

Decisions allow the program to perform different actions in certain conditions.

- For example, if a person applies for a driver's license and is not 16, then the computer should not give them a license.

To make a decision in a program we must:

- 1) Determine the ***condition*** in which to make the decision.
  - ⇨In the license example, we will not give a license if the person is under 16.
- 2) Tell the computer what actions to take if the condition is true or false.
  - ⇨A decision always has a *Boolean* or true/false answer.

The syntax for a decision uses the ***if*** statement.

Making Decisions Performing Comparisons

A ***comparison operator*** compares two values. Examples:

- 5 < 10
- N > 5 // N is a variable. Answer depends on what is N.

Comparison operators in JavaScript:

- > - Greater than
- >= - Greater than or equal
- < - Less than
- <= - Less than or equal
- == - Equal (Note: Not "=" which is used for assignment!)
- != - Not equal

The result of a comparison is a ***Boolean value*** which is either ***true*** or ***false***.

Making Decisions Example Comparisons

```
var j=25, k = 45;
var d = 2.5, e=2.51;

// Determine if these comparisons are true or false

(j == k)          // false
(j <= k);         // true
(d == e);         // ??
(d != e);         // ??
(k >= 25);        // ??
(25 == j);        // ??
(j > k);          // ??
(e < d);          // ??

 j = k;
(j == k);         // ??
```


Valid Comparison Operators Question

Question: Select the operator that is invalid (not allowed).

A) !=

B) ==

C) <=

D) ≥

Making Decisions
If Statement

To make decisions with conditions, we use the ***if*** statement.

- If the condition is true, the statement(s) after **`if`** are executed otherwise they are skipped.
- If there is an **`else`** clause, statements after **`else`** are executed if the condition is false.

Syntax:

```
if (condition)
   statement;
```

OR

```
if (condition)
   statement;
else
   statement;
```

Example:

```
if (age > 17)
   alert("Adult!");
```

OR

```
if (age > 17)
   alert("Adult!");
else
   alert("Kid!");
```


Making Decisions
Block Syntax

Currently, using our if statement we are only allowed to execute one line of code (one statement).

- What happens if we want to have more than one statement?

We use the ***block syntax*** for denoting a multiple statement block. A block is started with a "**{**" and ended with a "**}**".

- All statements inside the brackets are grouped together.

Example:

```
if (age > 17){

   window.alert("You are an adult");
   window.alert("You can vote!");
   ...
}
```

We will use block statements in many other situations as well.

Making Decisions
If Statement Example

```
var age;
var teenager, hasLicense;
age = window.prompt("Enter your age: ");

if (age > 19){
   teenager = false;
   hasLicense = true;
}
else if (age < 13){
   teenager = false;
   hasLicense = false;
}
else {
   teenager = true;  // Do not know if have license
   hasLicense = false;
}
document.write("Is teenager: "+teenager);
document.write("Has license? "+hasLicense);
```


Making Decisions

Question: What is the output of this code?

```
var num=10;

if (num > 10)
   document.write("big");
else
   document.write("small");
```

A) `big`

B) `small`

C) `bigsmall`

Making Decisions (2)

Question: What is the output of this code?

```
var num=10;

if (num != 10)
   document.write("big");
document.write("small");
```

A) `big`

B) `small`

C) `bigsmall`

Making Decisions (3)

Question: What is the output of this code?

```
var num=10;

if (num == 10){
   document.write("big");
   document.write("small");
}
```

A) `big`

B) `small`

C) `bigsmall`

Decision Practice Questions

1) Write a program that reads an integer *N*.

- If *N* < 0, print "Negative number", if *N* = 0, print "Zero", If *N* > 0, print "Positive Number".

2) Write a program that reads in a number for 1 to 5 and prints the English word for the number. For example, 1 is "one".

3) Write a program to read in your name and age and print them.

- a) Modify your program to also print "Not a teenager" if your age is greater than 19 otherwise print "Still a teenager".

Nested Conditions and Decisions Nested If Statement

We ***nest*** `if` statements for more complicated decisions.

- Verify that you use blocks appropriately to group your code!

Example:

```
if (age > 16){
   if (gender == "male"){
      document.write("Fast driver!");
   }else{
      document.write("Great driver!");
   }
}
else{
   document.write("Sorry! Too young to drive.");
}
```


Making Decisions Nested If Statement Example

```
var salary, tax;
var married;

married = window.prompt("Enter M=married, S=single: ");
salary = window.prompt("Enter your salary: ");

if (married == "S"){
   // Single person
   if (salary > 50000)
      tax = salary*0.5;
   else if (salary > 35000)
      tax = salary*0.45;
   else
      tax = salary*0.30;
}  // End if single person
```


Making Decisions Nested If Statement Example (2)

```
else if (married == "M"){
   // Married person
   if (salary > 50000)
      tax = salary*0.4;
   else if (salary > 35000)
      tax = salary*0.35;
   else
      tax = salary*0.20;
}  // End if married person
else  // Invalid input
   tax = -1;

if (tax != -1){
   document.write("Salary: "+salary+"<br/>");
   document.write("Tax: "+tax+"<br/>");
}else
   document.write("Invalid input!");
```


Nested Conditions and Decisions Dangling Else Problem

The ***dangling else problem*** occurs when a programmer mistakes an else clause to **belong to a different if** statement than it really does.

- Brackets determine which statements are grouped together, not indentation! By default, an else with no brackets matches the closest if statement regardless of indentation.

Example:

Incorrect

```
if (country == "US"))
   if (state == "HI"))
      shipping = 10.00;
else  // Belongs to 2nd if!
   shipping = 20.00; // Wrong!
```

Correct

```
if (country == "US") {
   if (state == "HI")
      shipping = 10.00;
} else
shipping = 20.00;
```


Nested Conditions and Decisions Boolean Expressions

A ***Boolean expression*** is a sequence of conditions combined using AND (**&&**), OR (**||**), and NOT (**!**).

- Allows you to test more complex conditions
- Group subexpressions using parentheses

Syntax:	*(expr1)* **&&** *(expr2)*	- expr1 AND expr2
	(expr1) **||** *(expr2)*	- expr1 OR expr2
	!(expr1)	- NOT expr1

Examples:

```
var b;

1) b = (x > 10) && !(x < 50);
2) b = (month == 1) || (month == 2) || (month == 3);
3) if (day == 28 && month == 2)
4) if !(num1 == 1 && num2 == 3)
5) b = ((10 > 5 || 5 > 10) && ((10>5 && 5>10));// False
```

Boolean Expressions

Question: Is `result` `true` or `false`?

```
var x = 10, y = 20;
var result = (x > 10) || (y < 20);
document.write(result);
```

A) `true`

B) `false`

Boolean Expressions (2)

Question: Is `result` `true` or `false`?

```
var x = 10, y = 20;
var result = !(x != 10) && (y == 20);
document.write(result);
```

A) `true`

B) `false`

Boolean Expressions (3)

Question: Is `result` `true` or `false`?

```
var x = 10, y = 20;
var result = (x >= y) || (y <= x);
document.write(result);
```

A) `true`

B) `false`

Making Decisions (4)

Question: What is the output of this code?

```
var num=12;

if (num >= 8)
   document.write("big");
   if (num == 10)
      document.write("ten");
else
   document.write("small");
```

A) `big`

B) `small`

C) `bigsmall`

D) `ten`

E) `bigten`

Making Decisions (5)
Boolean Expressions

Question: What is the output of this code?

```
var x = 10, y = 20;

if (x >= 5){
   document.write("bigx");
   if (y >= 10)
      document.write("bigy");
}
else if (x == 10 || y == 15)
   if (x < y && x != y)
      document.write("not equal");
```

A) `bigx`

B) `bigy`

C) `bigxnot equal`

D) `bigxbigynot equal`

E) `bigxbigy`

Practice Questions

1) Create the Boolean expressions in JavaScript for:

- a) x does not equal y OR y is greater than z
- b) x is greater than 0 AND less than 100
- c) x is not less than 0 OR greater than 100

2) Write a program that reads two numbers and prints them in sorted, descending order. Challenge: Do it for three numbers.

3) Challenge: Write a program that translates a letter grade into a number grade.

- Letter grades are A,B,C,D,F possibly followed by + or - with values 4,3,2,1, and 0. There is no F+ or F-. A + increases the value by 0.3, a - decreases it by 0.3. An A+ equals 4.0.
- You need to use two functions:
  - ⇨<variableName>.length – length of string given by variableName
  - ⇨<variableName>.charAt(0) – character at position 0 in string

Conclusion

We learned the basics of the JavaScript language to communicate instructions to the computer including:

- declaring and using variables
- initialization and assignment of values to variables
- expressions
- decisions and Boolean conditions
  - ⇨ ***decisions*** – performing different actions based on testing a condition

Objectives

- Write decisions using the if statement.
- Define: Boolean, condition
- List and use the comparison operators.
- Explain the dangling else problem.
- Construct and evaluate Boolean expressions using AND, OR, and NOT.