



COSC 122

Computer Fluency

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);         // ??
```

CQ 8.11- Valid Comparison Operators

Question

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

A) $!=$

B) $==$

C) $<=$

D) \geq

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.

CQ 8.12- 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

CQ 8.13- 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

CQ 8.14- 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

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);
```

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`

CQ 8.15- 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

CQ 8.16- 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

CQ 8.17- 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

CQ 8.18- 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

CQ 8.19- 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.