Internet programiranje predavanje 04

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Operatori na nivou bita

- operacije nad celobrojnim brojevima dužine 32 bita
- Ukoliko operanad nije ceo broj dužine 32 bita, pokušaće se izvršiti konverzija u traženi tip, tek onda se primenjuje operacija
- celobrojni brojevi se razmatraju na nivou bita i obavljaju operacije nad bitovima

logičke operacije na nivou bita

- Logičko I (AND) a & b
  Rezultat se dobija 1, jedino ako su oba bita 1, u ostalim slučajevima rezultat je 0
- Logičko ILI (OR) a | b
  Rezultat se dobija 0, jedino ako su oba bita 0, u ostalim slučajevima rezultat je 1
- Logičko ekskluzivno ILI (XOR) a ^ b
  Rezultat se dobija 1, ako biti imaju različite vrednosti, u slučaju da imaju iste vrednosti, rezultat je 0
- Logičko NE (NOT) ~ a
  Komplementira bitove operanda a

operacije pomeranja na nivou bita

- Pomeranje ulevo a << b
  Pomera binarni sadržaj operanda a za b mesta ulevo.
  Prazna mesta popunjava sa vrednošću 0
- Pomeranje udesno sa znakom a >> b
  Pomera binarni sadržaj operanda a za b mesta udesno.
  Prazna mesta popunjavju sa vrednošću najstarijeg bita
- Pomeranje udesno sa nulama a >>> b
  Pomera binarni sadržaj operanda a za b mesta udesno.
  Prazna mesta popunjavju sa vrednošću 0

Logički operatori

• I (&&)	expr1 && expr2	Logičko I
• ILI (||)	expr1 || expr2	Logičko ILI
• NE (!)	!expr	Negacija

Operatori poređenja

- obavljaju poređenje dve vrednosti i kao rezultat vraćaju vrednost logičkog tipa
- tip podataka celobrojan, racionalni, karakter, String i logički tip mogu se upoređivati koristeći operatore == i !=
- Samo numerički tipovi koriste ostale operatore

Operatori poređenja

- Jednakost (==)
  Rezultat je true, ako su operandi jednaki - vrši se konverzija podataka
- Nejednakost (!=)
  Rezultat je true, ako su operandi različiti - vrši se konverzija podataka

celobrojan, racionalni, karakter, string i logički tip

operatore vrednosti 5 i "5" su isti

Operatori poređenja

- Jednako bez konverzije tipova (===)
- Različito bez konverzije tipova (!==)

samo za brojeve

operatore vrednosti 5 i "5" su različiti

rezultat je false ili true

Operatori poređenja

- Veće (>)
  Rezultat je true, ako je levi operand veći od desnog operanda
- Veće ili jednako (>=)
  Rezultat je true, ako je levi operand veći ili jednak desnom
- Manje (<)
  Rezultat je true, ako je levi operand manji od desnog operanda
- Manje ili jednako (<=)
  Rezultat je true, ako je levi operand manji ili jednak desnom
- Jednako bez konverzije tipova (===)
  Rezultat je true, ako su operandi jednaki bez konverzije
- Različito bez konverzije tipova (!==)
  Rezultat je true, ako su operandi različiti bez konverzije podataka

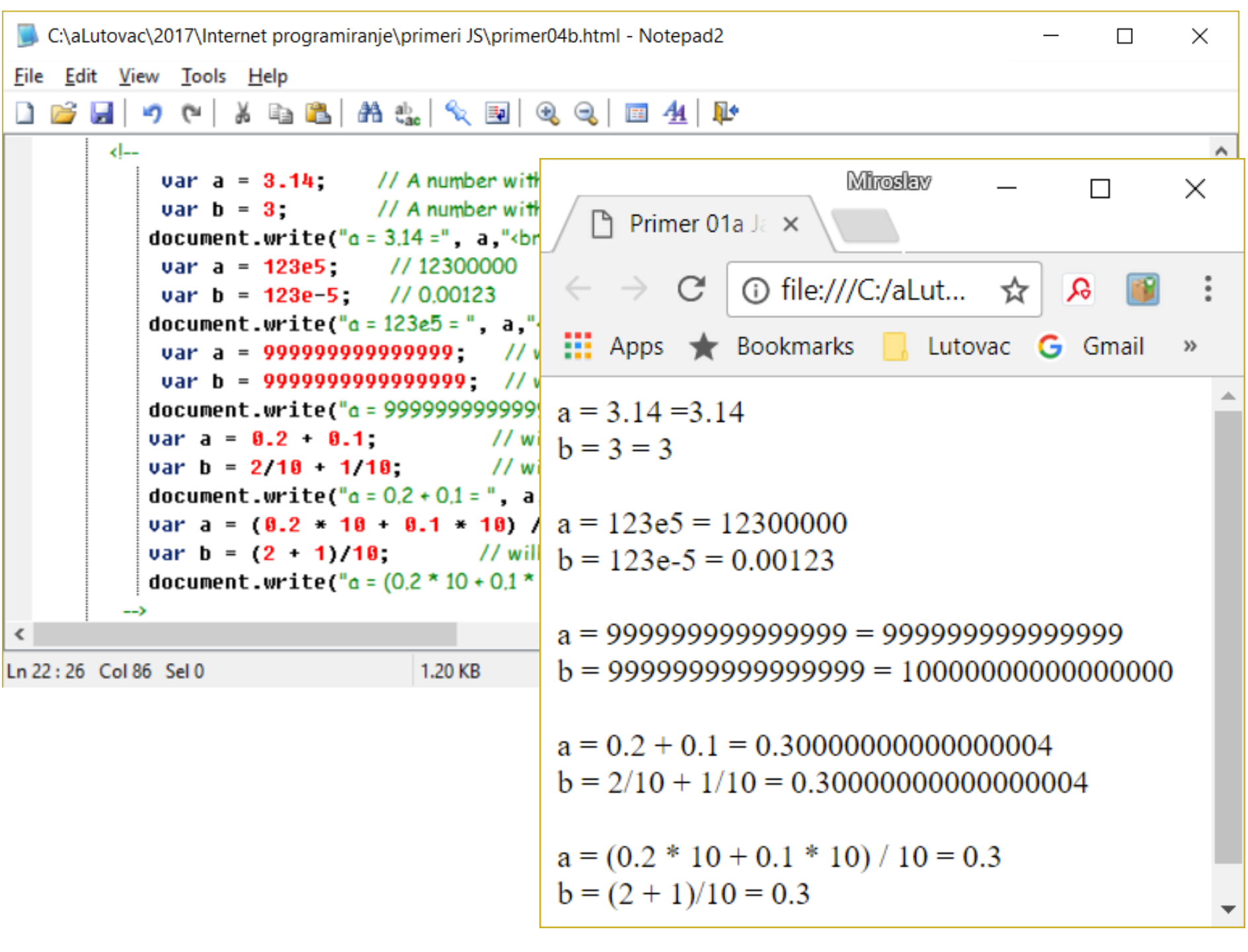
Samo za brojeve

Predstavljanje brojeva

- brojevi su u dvostrukoj tačnosti sa pokretnom tačkom, IEEE 754 standard
- format je 64 bita
- za mantisu se koriste biti 0 do 51
- eksponent su biti 52 do 62
- znak je u bitu 63

Tačnost

- Celi brojevi do 15 cifara su tačni
- Najveži broj cifara je 17, ali aritmetika sa pokretnim zarezom nije uvek 100% tačna


C:\aLutovac\2017\Internet programiranje\primeri JS\primer04b.html - Notepad2
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<!--
var a = 3.14; // A number with
var b = 3; // A number with
document.write("a = 3.14 =", a,"<br
var a = 123e5; // 12300000
var b = 123e-5; // 0.00123
document.write("a = 123e5 = ", a,"
var a = 999999999999999; // w
var b = 9999999999999999; // w
document.write("a = 999999999999
var a = 0.2 + 0.1; // wi
var b = 2/10 + 1/10; // wi
document.write("a = 0.2 + 0.1 = ", a
var a = (0.2 * 10 + 0.1 * 10) /
var b = (2 + 1)/10; // will
document.write("a = (0.2 * 10 + 0.1 *
-->
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1.20 KB
Miroslav
Primer 01a J
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a = 3.14 =3.14
b = 3 = 3
a = 123e5 = 12300000
b = 123e-5 = 0.00123
a = 999999999999999 = 999999999999999
b = 9999999999999999 = 10000000000000000
a = 0.2 + 0.1 = 0.30000000000000004
b = 2/10 + 1/10 = 0.30000000000000004
a = (0.2 * 10 + 0.1 * 10) / 10 = 0.3
b = (2 + 1)/10 = 0.3

Sabiranje brojeva i stringova

- Brojevi se sabiraju a stringovi nadovezuju

```
var x = 10;
var y = 20;
var z = x + y;          // will be 30 (a number)

var x = "10";
var y = "20";
var z = x + y;          // will be 1020 (a string)
```

Sabiranje brojeva i stringova

- Bojevi i stringovi

  brojevi se konvertuju u stringove

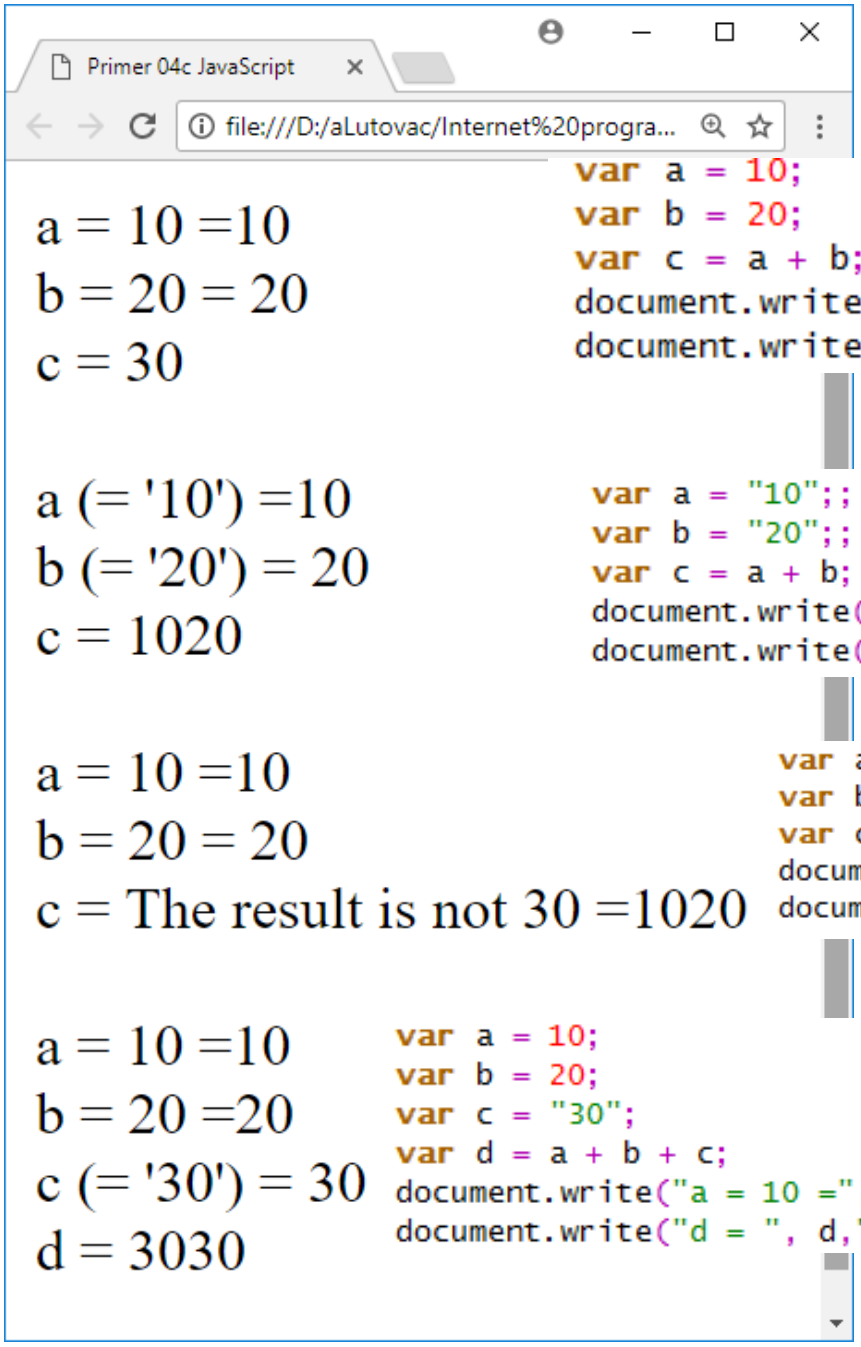
```
var x = "10";
var y = 20;
var z = x + y;          // will be 1020 (a string)
```

```
var x = 10;
var y = 20;
var z = "The result is: " + x + y;     //NIJE 30
```

Sabiranje brojeva i stringova

- Kompajler radi s leva u desno;
  prvo saber 10 + 20 i doda kao string sledećem:
  dobija se 30 + "30" zato što je naredni string

```
var x = 10;
var y = 20;
var z = "30";
var result = x + y + z;    //NIJE 102030
```



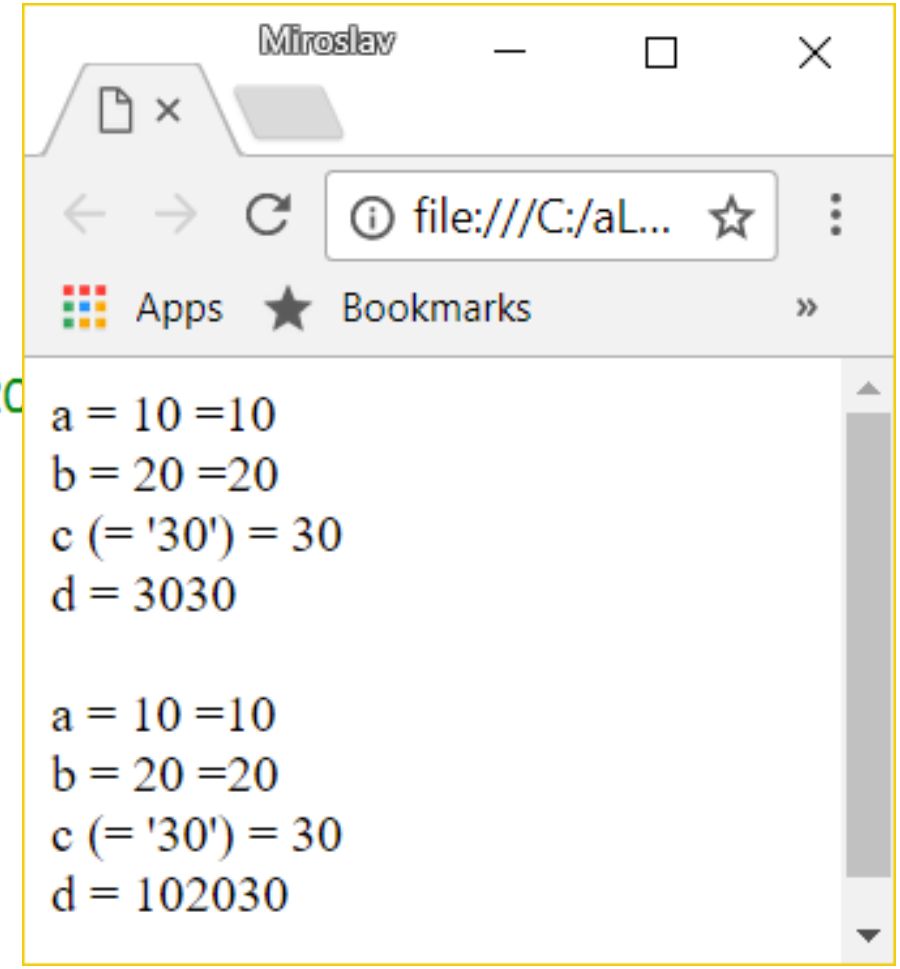

```
var a = 10;
var b = 20;
var c = a + b;              // will be 30 (a number)
document.write("a = 10 =", a,"<br>","b = 20 = ", b,"<br>");
document.write("c = ", c,"<br><br>");
```

```
var a = "10";;
var b = "20";;
var c = a + b;              // will be 1020 (a string)
document.write("a (= '10') =", a,"<br>","b (= '20') = ", b,"<br>");
document.write("c = ", c,"<br><br>");
```

```
var a = 10;
var b = 20;
var c = "The result is not 30 =" + a + b;            //NIJE 30
document.write("a = 10 =", a,"<br>","b = 20 = ", b,"<br>");
document.write("c = ", c,"<br><br>");
```

```
var a = 10;
var b = 20;
var c = "30";
var d = a + b + c;
document.write("a = 10 =", a,"<br>","b = 20 =", b,"<br>","c (= '30') = ", c,"<br>
document.write("d = ", d,"<br><br>");
```

```
var a = 10;
var b = 20;
var c = "30";
var d = a + b + c;
document.write("a = 10 =", a,"<br>","b = 20 =", b,"<br>","c (= '30') = ", c,"<br>");
document.write("d = ", d,"<br><br>");

var a = 10;
var b = 20;
var c = "30";
var d = a + (b + c);
document.write("a = 10 =", a,"<br>","b = 20
document.write("d = ", d,"<br><br>");
```

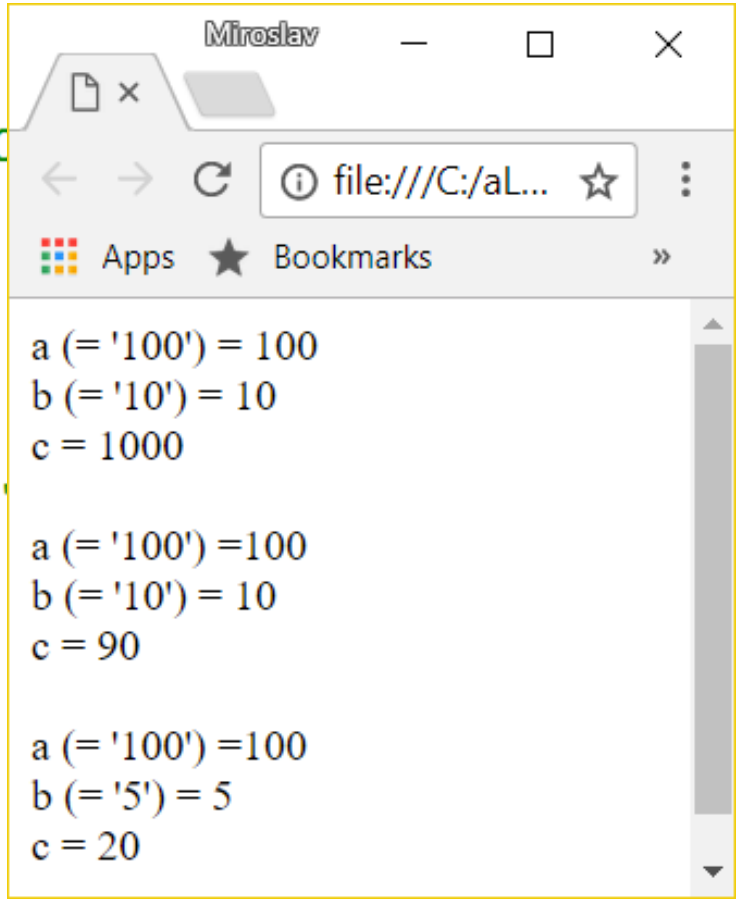


Sabiranje brojeva i stringova

- Brojevi se mogu zadati na dva načina

```
var x = "100";
var y = "10";
var z = x * y;       // will be 1000

var a = "100";
var b = "10";
var c = a - b;       // will be 90
```

```
var a ="100";
var b = "10";
var c = a * b;
document.write("a (= '100') = ", a,"<br>","b (= '10') = ", b,"<br>")
document.write("c = ", c,"<br><br>");

var a = "100";
var b = "10";
var c = a - b;
document.write("a (= '100') =", a,"<br>","b (= '10
document.write("c = ", c,"<br><br>");

var a = "100";
var b = "5";
var c = a / b;
document.write("a (= '100') =", a,"<br>","b (= '5'
document.write("c = ", c,"<br><br>");
```



Sabiranje brojeva i stringova

- Brojevi se mogu zadati na dva načina

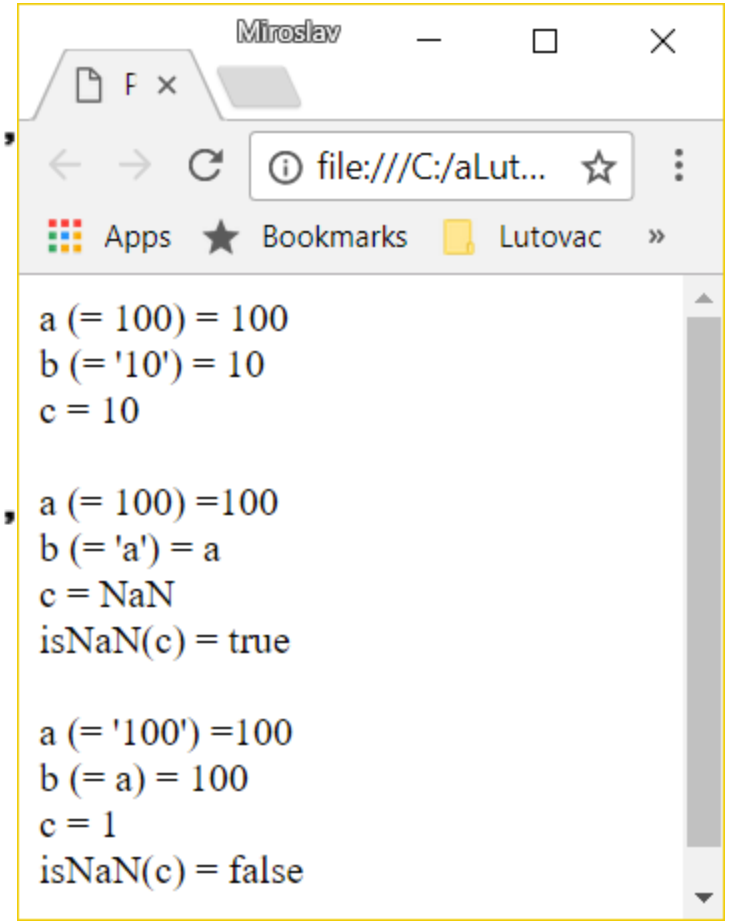
```
var x = "100";
var y = "10";
var z = x + y;       // will be 10010, not 110
```

Samo kod sabiranja je konkatenacija

NaN - Not a Number

```
var x = 100 / "A";       // will be NaN

var x = 100 / "10";      // will be 10

var x = 100 / "Apple";
isNaN(x);        // returns true, it is Not a Number
```

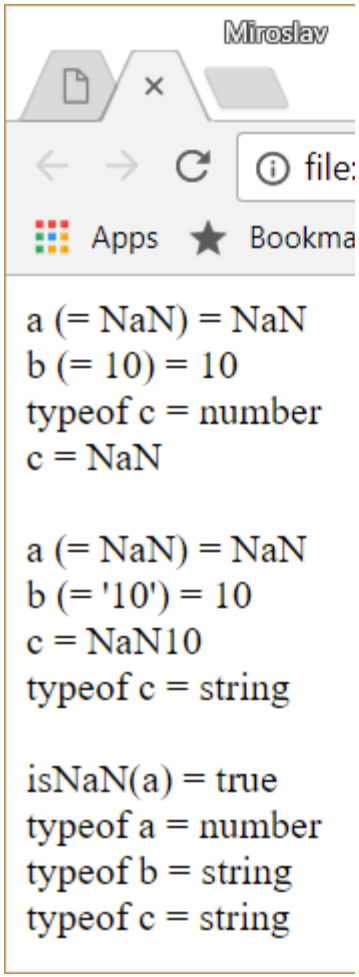
```
var a = 100;
var b = "10";
var c = a / b;
document.write("a (= 100) = ", a,"<br>","b (= '10') = ", b,"<br>");
document.write("c = ", c,"<br><br>");

var a = 100;
var b = "a";
var c = a / b;
document.write("a (= 100) =", a,"<br>","b (= 'a') = ", b,
document.write("c = ", c,"<br>");
document.write("isNaN(c) = ", isNaN(c),"<br><br>");

var a = "100";
var b = a;
var c = a / b;
document.write("a (= '100') =", a,"<br>","b (= a) = ", b,
document.write("c = ", c,"<br>");
document.write("isNaN(c) = ", isNaN(c),"<br><br>");
```



NaN - Not a Number

```
var x = NaN;
var y = 5;
var z = x + y;        // will be NaN


var x = NaN;
var y = "5";
var z = x + y;        // will be NaN5
```

konkatenacija




```
var a = NaN;
var b = 10;
var c = a + b;
document.write("a (= NaN) = ", a,"<br>","b (= 10) = ", b,"<br>");
document.write("typeof c = ", typeof c,"<br>");
document.write("c = ", c,"<br><br>");

var a = NaN;
var b = "10";
var c = a + b;
document.write("a (= NaN) = ", a,"<br>","b (= '10') = ", b,"<br>");
document.write("c = ", c,"<br>");
document.write("typeof c = ", typeof c,"<br><br>");

document.write("isNaN(a) = ", isNaN(a),"<br>");
document.write("typeof a = ", typeof a,"<br>");
document.write("typeof b = ", typeof b,"<br>");
document.write("typeof c = ", typeof c,"<br><br>");
```

NaN - Not a Number

```
typeof NaN;          // returns "number"
```

NaN - Not a Number

```
var x = NaN;
var y = 5;
var z = x + y;        // will be NaN
```

Svaka operacija sa brojevima gde je jedan činilac broj NaN, daje NaN

type of x daje number

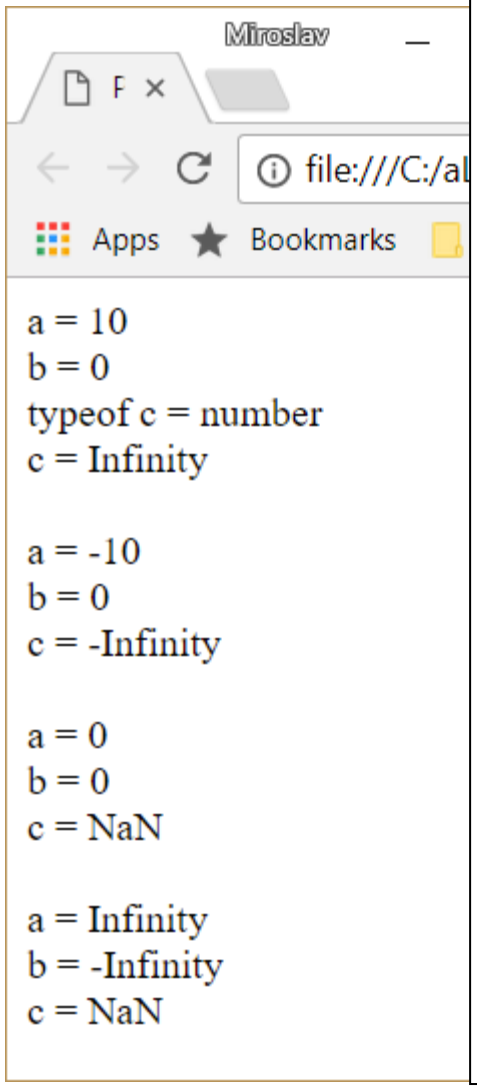
```
var x = NaN;
var y = "5";
var z = x + y;        // will be NaN5
```

konkatenacija

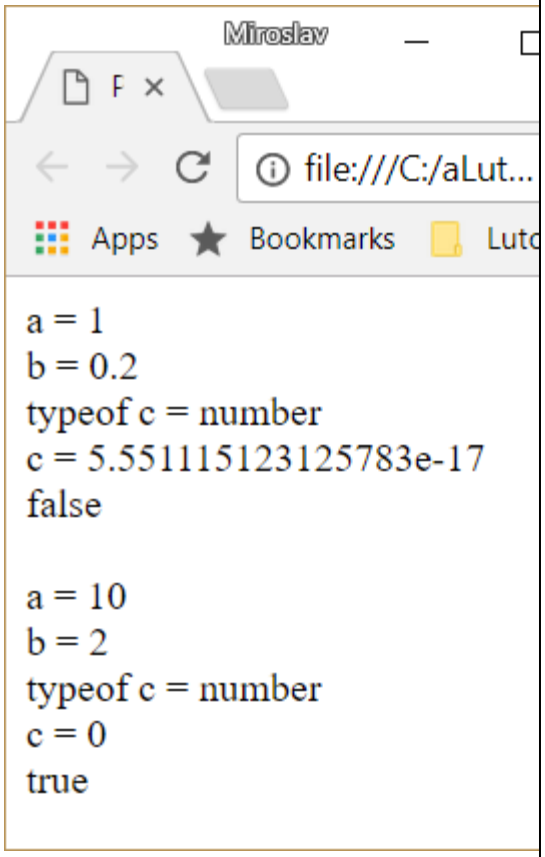
Infinity

- Infinity (or -Infinity) se dobija kada je broj izvan opsega

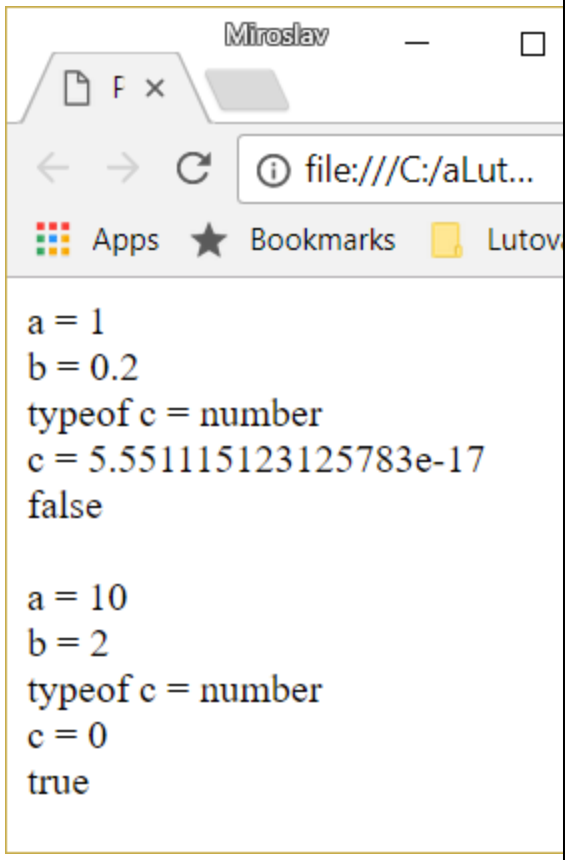
```
var x =  2 / 0;          // will be Infinity
var y = -2 / 0;          // will be -Infinity

typeof Infinity;         // returns "number"
```




```
var a = 10;
var b = 0;
var c = a / b;
document.write("a = ", a,"<br>","b = ", b,"<br>");
document.write("typeof c = ", typeof c,"<br>");
document.write("c = ", c,"<br><br>");
var a = -10;
var b = 0;
var c = a / b;
document.write("a = ", a,"<br>","b = ", b,"<br>");
document.write("c = ", c,"<br><br>");
var a = 0;
var b = 0;
var c = a / b;
document.write("a = ", a,"<br>","b = ", b,"<br>");
document.write("c = ", c,"<br><br>");
var a = 10/0;
var b = -10/0;
var c = a + b;
document.write("a = ", a,"<br>","b = ", b,"<br>");
document.write("c = ", c,"<br><br>");
```




```
var a = 1;
var b = 0.2;
c=a-b; c=c-b;c=c-b;c=c-b;c=c-b;
document.write("a = ", a,"<br>","b = ", b,"<br>");
document.write("typeof c = ", typeof c,"<br>");
document.write("c = ", c,"<br>");
document.write(c==0,"<br><br>");

var a = 10;
var b = 2;
c=a-b; c=c-b;c=c-b;c=c-b;c=c-b;
document.write("a = ", a,"<br>","b = ", b,"<br>");
document.write("typeof c = ", typeof c,"<br>");
document.write("c = ", c,"<br>");
document.write(c==0,"<br><br>");
```




```
var a = 1;
var b = 0.2;
c=a-b; c -=b; c -=b; c -=b; c -=b;
document.write("a = ", a,"<br>","b = ", b,"<br>");
document.write("typeof c = ", typeof c,"<br>");
document.write("c = ", c,"<br>");
document.write(c==0,"<br><br>");

var a = 10;
var b = 2;
c=a-b; c -=b; c -=b; c -=b; c -=b;
document.write("a = ", a,"<br>","b = ", b,"<br>");
document.write("typeof c = ", typeof c,"<br>");
document.write("c = ", c,"<br>");
document.write(c==0,"<br><br>");
```

Osnova 16, 8, 2

```
var x = 0xFF;          // will be 255

var myNumber = 128;
myNumber.toString(16);  // returns 80
myNumber.toString(8);   // returns 200
myNumber.toString(2);   // returns 10000000
```

Osnova bojeva je 10 decimals.
toString() method se koristi da se dobije broj u osnovi 16 (hex), 8 (octal) ili 2 (binary)

Brojevi mogu biti objekti

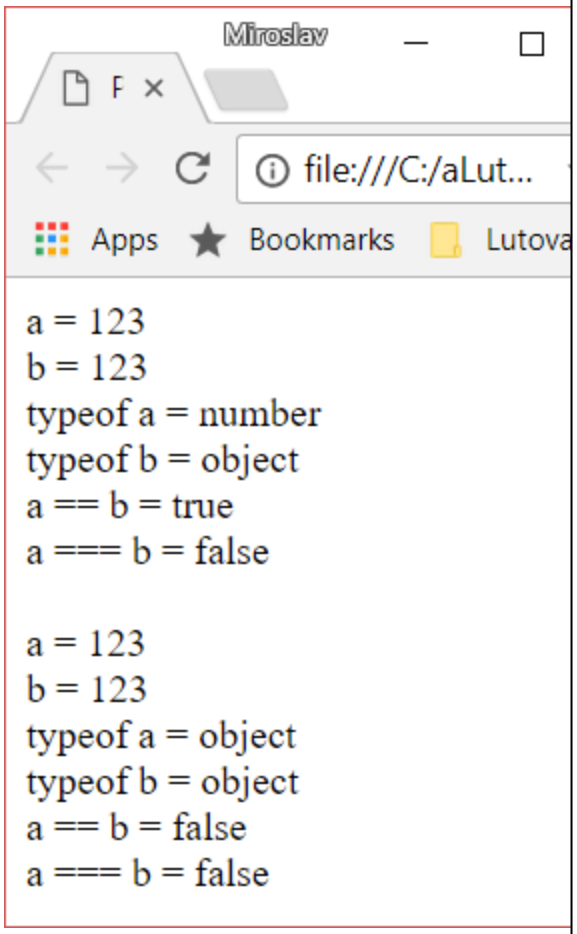
```
var x = 123;            // typeof x returns number
var y = new Number(123);
                        // typeof y returns object
var x = 500;
var y = new Number(500);
  // (x == y) is true because x and y have equal values
```

Nemojte da pravite Number objects.
Usporava brzinu izvršavanja.
Ključna reč **new** komplikuje kod.
Može da uzrokuje neočekivane rezultate!

Brojevi mogu biti objekti

```
var x = 500;

var y = new Number(500);

// (x === y) is false because x and y have different types


var x = new Number(500);
var y = new Number(500);
// (x == y) is false because objects cannot be compared
```

Objekti ne mogu da se upoređuju!
Upoređivanje dva JavaScript objekta vraća false.

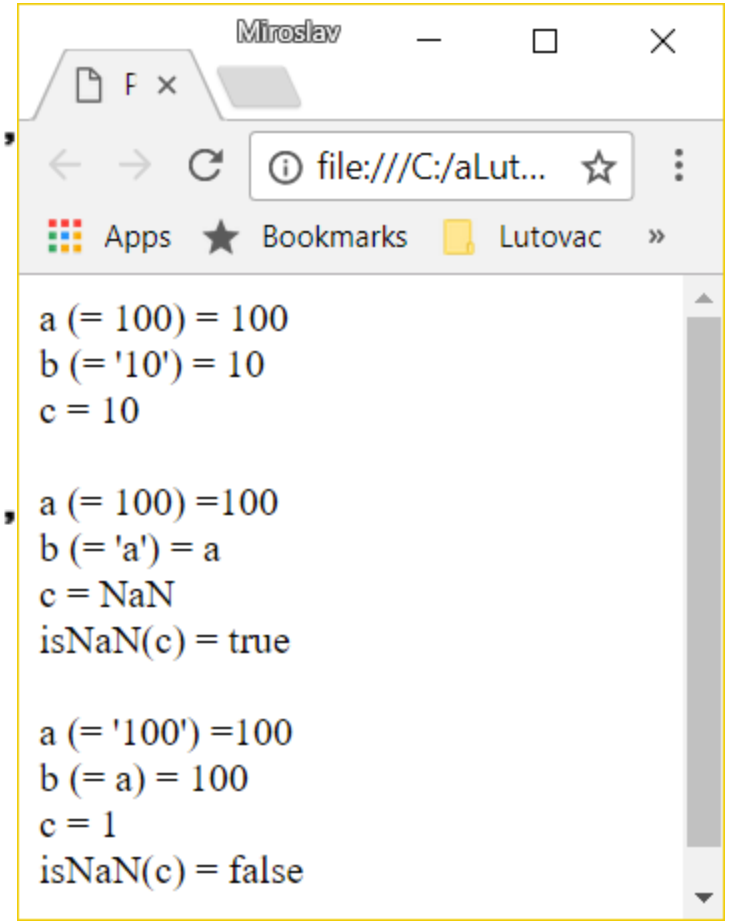


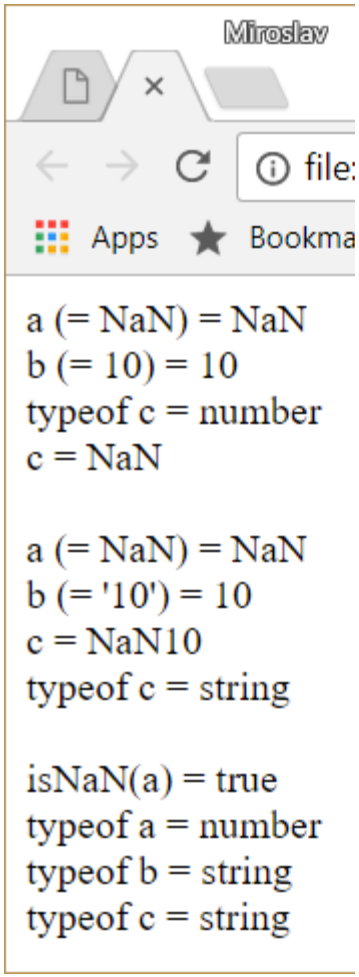

```
var a = 123;
var b = new Number(123);
document.write("a = ", a,"<br>");
document.write("b = ", b,"<br>");
document.write("typeof a = ", typeof a,"<br>");
document.write("typeof b = ", typeof b,"<br>");
document.write("a == b = ", (a == b),"<br>");
document.write("a === b = ", (a === b),"<br><br>");

var a = new Number(123);
var b = new Number(123);
document.write("a = ", a,"<br>");
document.write("b = ", b,"<br>");
document.write("typeof a = ", typeof a,"<br>");
document.write("typeof b = ", typeof b,"<br>");
document.write("a == b = ", (a == b),"<br>");
document.write("a === b = ", (a === b),"<br><br>");
```

NaN - Not a Number

```
var x = 100 / "A";        // will be NaN

var x = 100 / "10";       // will be 10

var x = 100 / "Apple";
isNaN(x);          // returns true, it is Not a Number
```

```
var a = 100;
var b = "10";
var c = a / b;
document.write("a (= 100) = ", a,"<br>","b (= '10') = ", b,"<br>");
document.write("c = ", c,"<br><br>");

var a = 100;
var b = "a";
var c = a / b;
document.write("a (= 100) =", a,"<br>","b (= 'a') = ", b,
document.write("c = ", c,"<br>");
document.write("isNaN(c) = ", isNaN(c),"<br><br>");

var a = "100";
var b = a;
var c = a / b;
document.write("a (= '100') =", a,"<br>","b (= a) = ", b,
document.write("c = ", c,"<br>");
document.write("isNaN(c) = ", isNaN(c),"<br><br>");
```



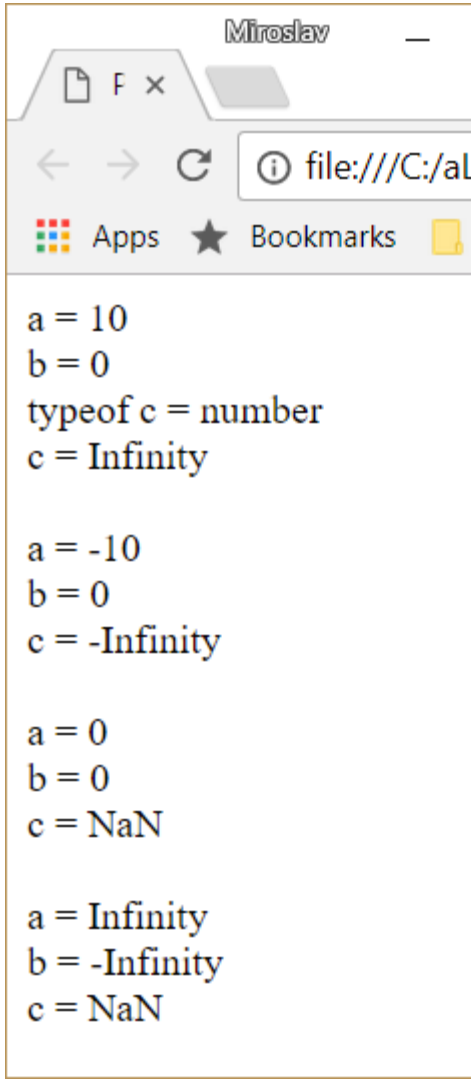



```
var a = NaN;
var b = 10;
var c = a + b;
document.write("a (= NaN) = ", a,"<br>","b (= 10) = ", b,"<br>");
document.write("typeof c = ", typeof c,"<br>");
document.write("c = ", c,"<br><br>");

var a = NaN;
var b = "10";
var c = a + b;
document.write("a (= NaN) = ", a,"<br>","b (= '10') = ", b,"<br>");
document.write("c = ", c,"<br>");
document.write("typeof c = ", typeof c,"<br><br>");

document.write("isNaN(a) = ", isNaN(a),"<br>");
document.write("typeof a = ", typeof a,"<br>");
document.write("typeof b = ", typeof b,"<br>");
document.write("typeof c = ", typeof c,"<br><br>");
```

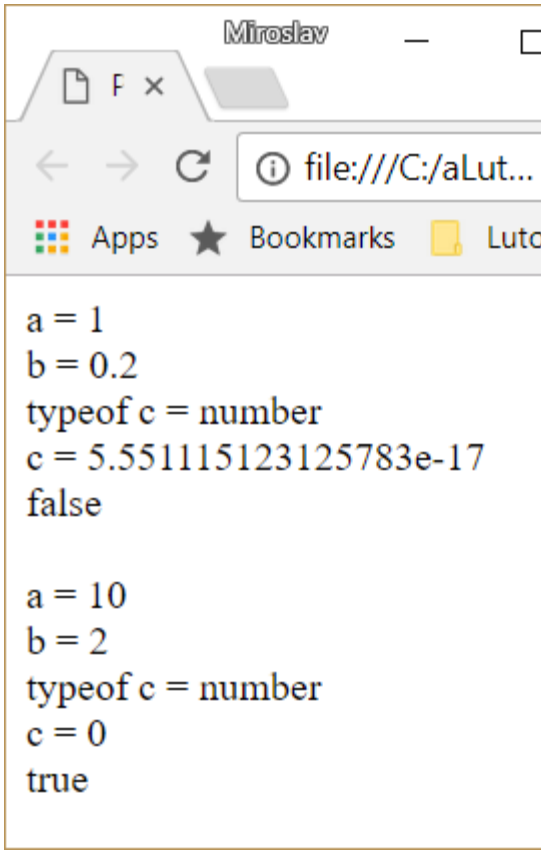
Infinity

- Infinity (or -Infinity) se dobija kada je broj izvan opsega

```
var x =  2 / 0;          // will be Infinity
var y = -2 / 0;          // will be -Infinity

typeof Infinity;         // returns "number"
```




```
var a = 10;
var b = 0;
var c = a / b;
document.write("a = ", a,"<br>","b = ", b,"<br>");
document.write("typeof c = ", typeof c,"<br>");
document.write("c = ", c,"<br><br>");
var a = -10;
var b = 0;
var c = a / b;
document.write("a = ", a,"<br>","b = ", b,"<br>");
document.write("c = ", c,"<br><br>");
var a = 0;
var b = 0;
var c = a / b;
document.write("a = ", a,"<br>","b = ", b,"<br>");
document.write("c = ", c,"<br><br>");
var a = 10/0;
var b = -10/0;
var c = a + b;
document.write("a = ", a,"<br>","b = ", b,"<br>");
document.write("c = ", c,"<br><br>");
```




```
var a = 1;
var b = 0.2;
c=a-b; c=c-b;c=c-b;c=c-b;c=c-b;
document.write("a = ", a,"<br>","b = ", b,"<br>");
document.write("typeof c = ", typeof c,"<br>");
document.write("c = ", c,"<br>");
document.write(c==0,"<br><br>");

var a = 10;
var b = 2;
c=a-b; c=c-b;c=c-b;c=c-b;c=c-b;
document.write("a = ", a,"<br>","b = ", b,"<br>");
document.write("typeof c = ", typeof c,"<br>");
document.write("c = ", c,"<br>");
document.write(c==0,"<br><br>");
```

Osnova 16, 8, 2

```
var x = 0xFF;          // will be 255

var myNumber = 128;
myNumber.toString(16);  // returns 80
myNumber.toString(8);   // returns 200
myNumber.toString(2);   // returns 10000000
```

Osnova bojeva je 10 decimals.
toString() method se koristi da se dobije broj u osnovi 16 (hex), 8 (octal) ili 2 (binary)

Brojevi mogu biti objekti

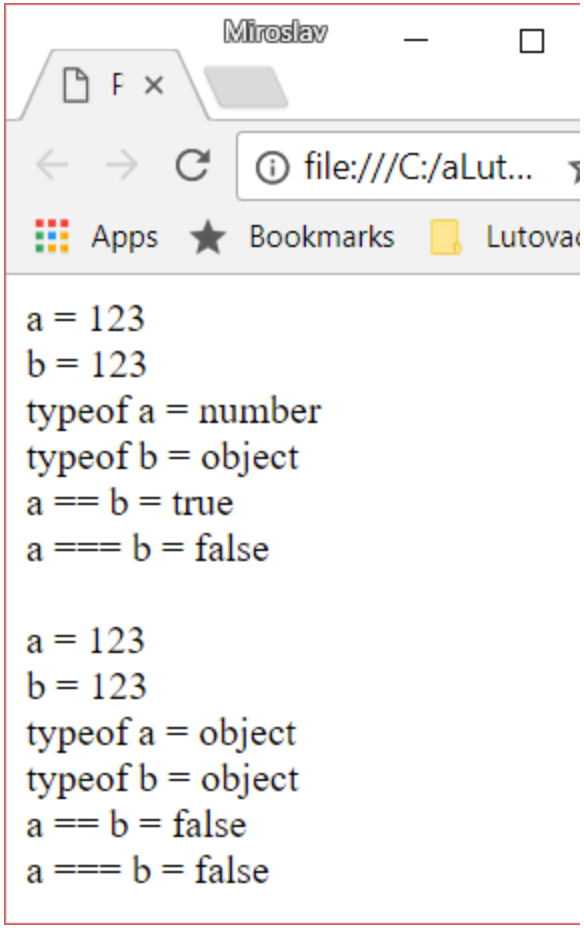
```
var x = 123;            // typeof x returns number
var y = new Number(123);
                        // typeof y returns object
var x = 500;
var y = new Number(500);
  // (x == y) is true because x and y have equal values
```

Nemojte da pravite Number objects.
Usporava brzinu izvršavanja.
Ključna reč **new** komplikuje kod.
Može da uzrokuje neočekivane rezultate!

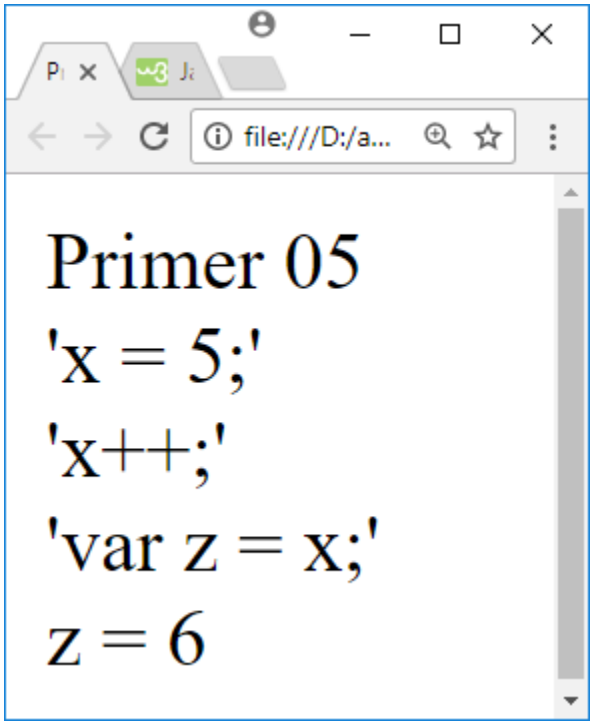
Brojevi mogu biti objekti

```
var x = 500;

var y = new Number(500);

// (x === y) is false because x and y have different types


var x = new Number(500);
var y = new Number(500);
// (x == y) is false because objects cannot be compared
```

Objekti ne mogu da se upoređuju!
Upoređivanje dva JavaScript objekta vraća false.




```
var a = 123;
var b = new Number(123);
document.write("a = ", a,"<br>");
document.write("b = ", b,"<br>");
document.write("typeof a = ", typeof a,"<br>");
document.write("typeof b = ", typeof b,"<br>");
document.write("a == b = ", (a == b),"<br>");
document.write("a === b = ", (a === b),"<br><br>");

var a = new Number(123);
var b = new Number(123);
document.write("a = ", a,"<br>");
document.write("b = ", b,"<br>");
document.write("typeof a = ", typeof a,"<br>");
document.write("typeof b = ", typeof b,"<br>");
document.write("a == b = ", (a == b),"<br>");
document.write("a === b = ", (a === b),"<br><br>");
```



primer05a.js - Notepad2

File Edit View Settings ?

```
1 var x = 5;
2 x++;
3 var z = x;
4 document.write("Primer 05");
5 document.write("<br>'x = 5;' <br>'x++;'<br>'var z = x;' <br>z = ",z);
```

Ln 5 : 5 Col 70 Sel 0 | 129 bytes | ANSI | CR+LF | INS | JavaScript

Miroslav

Primer 05b JavaSc

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Apps Bookmarks Lutovac Gmail

Primer 05
'x = 5;'
'x++;'
'var z = x;'
z = 6

txt1 = 'What a very ';
txt1 += ' nice day';'
txt2 = txt1;
txt2 = What a very nice day

C:\aLutovac\2017\viser 2017\Internet programiranje\primeri JS\primer05b.js

File Edit View Tools Help

```
var x = 5;
x++;
var z = x;
document.write("Primer 05");
document.write("<br>'x = 5;' <br>'x++;'<br>'var z = x;' <br>z = ",z);

txt1 = 'What a very ';
txt1 += '  nice day';
txt2 = txt1;
document.write("<br><br>txt1 = 'What a very ';");
document.write("<br>txt1 += '   nice day';'<br>txt2 = txt1;<br>txt2 = ", txt2);
```

Ln 8 : 12 Col 12 Sel 0 | 328 Bytes | ANSI | CR+LF | INS | JavaScript

C:\aLutovac\2017\viser 2017\Internet programiranje\primeri JS\primer05c.js - Not...

File Edit View Tools Help

```
var x = 5;
x+;
var z = x;
document.write("Primer
document.write("<br>'x
```

Ln 7 : 15 Col 37 Sel 0

C:\aLutovac\2017\viser 2017\Internet programiranje\primeri JS\pri...

File Edit View Tools Help

```
document.write("txt1 = 'What a very ';");
document.write("<br>txt1 ++= '   nice day';'<br>txt2 = txt1; "
txt1 = 'What a very ';
txt1 ++= '  nice day';
txt2 = txt1;
document.write("<br>txt2 = ", txt2);

/*
var x = 5;
x+;
var z = x;
document.write("Primer 05");
document.write("<br>'x = 5;' <br>'x++;'<br>'var z = x;' <br>z = ",z);
*/
```

Ln 15 : 15 Col 1 Sel 0 | 351 Bytes | ANSI | CR+LF | INS | JavaScript

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File Edit View Tools Help

```
document.write("txt1 = '
document.write("<br>txt1
txt1 = 'What a very ';
txt1 ++=    nice day';
txt2 = txt1;
document.write("<br>txt2 = ", txt2);
```

Ln 15 : 15 Col 1 Sel 0 | 351 Bytes | ANSI | CR+LF | INS | JavaScript

greška!

C:\aLutovac\2017\viser 2017\Internet programira...

File Edit View Tools Help

```
var x = 5 & 1;

document.write("Primer 05");
document.write("<br>x = 5 & 1;");
document.write("<br>0101 & 0001 = 0001 ");
document.write("<br>x = ",x);

var a = 17;
document.write("<br><br>a = ",a);
document.write("<br>a = ",a.toString(2));
var b = 1;
document.write("<br>b = ",b.toString(2));
var c = a & b;
document.write("<br>c = ",c.toString(2));
```

Ln 15 : 15 Col 1 Sel 0 | 365 Bytes | ANSI | CR+LF | INS | JavaScr

Miroslav

file:///C

Apps Bookmarks

Primer 05
x = 5 & 1;
0101 & 0001 = 0001
x = 1

a = 17
a = 10001
b = 1
c = 1

C:\aLutovac\2017\viser 2017\Internet pr...

File Edit View Tools Help

```
var x = 5 | 2;
document.write("Primer 05");
document.write("<br>x = 5 | 2;");
document.write("<br>0101 | 0010 = 0111 ");
document.write("<br>x = ",x.toString(2));
document.write("<br>x = ",x);

var a = 18;
document.write("<br><br>a = ",a);
document.write("<br>a = ",a.toString(2));
var b = 1;
document.write("<br>b = ",b.toString(2));
var c = a | b;
document.write("<br>var c = a | b = ",c);
document.write("<br>c = ",c.toString(2));
```

Ln 14 : 16 Col 36 Sel 0 449 Bytes ANSI CR+LF INS

Miroslav

file:///C:/aL

Apps Bookmarks

Primer 05
x = 5 | 2;
0101 | 0010 = 0111
x = 111
x = 7

a = 18
a = 10010
b = 1
var c = a | b = 19
c = 10011

Miroslav

file://

Apps Bookmarks

Primer 05
x = 5
~x = -6
x&(~x) = 0

x = 101
~x = -110
x&(~x) = 0

C:\aLutovac\2017\viser 2017\Internet programiranje\p...

File Edit View Tools Help

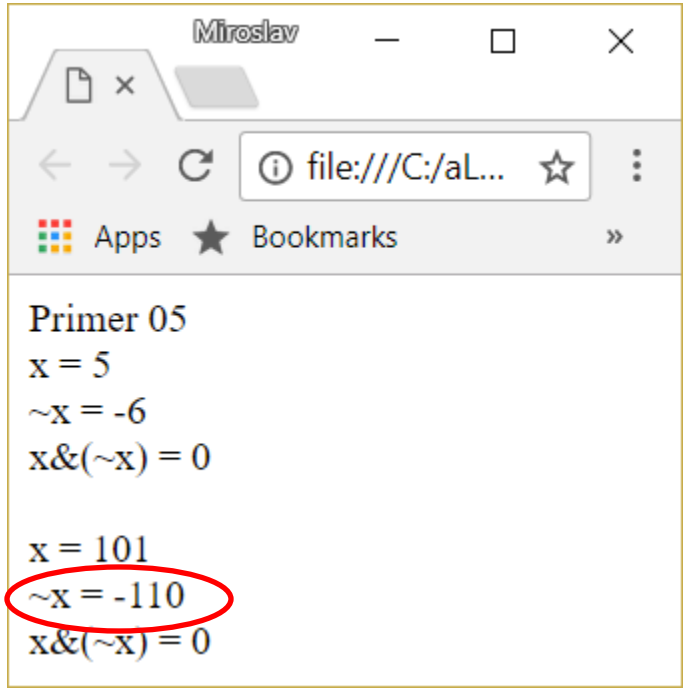
```
var x = 5;
var y = ~x;
document.write("Primer 05");
document.write("<br>x = ",x);
document.write("<br>~x = ",y);
document.write("<br>x&(~x) = ",x&y);

document.write("<br><br>x = ",x.toString(2));
document.write("<br>~x = ",y.toString(2));
document.write("<br>x&(~x) = ",(x&y).toString(2));
```

Ln 6 : 11 Col 27 Sel 0 | 301 Bytes | ANSI | CR+LF | INS | JavaScript

greška?

Primer sa 4 bita

0101 & 0001	0001
0101 | 0001	0101
~0101	1010
0101 << 1	1010
0101 ^ 0001	0100
0101 >> 1	0010
0101 >>> 1	0010



Primer sa 4 bita je unsigned binary numbers
Zato ~5 returns 10

00000000000000000000000000000101 (5)

11111111111111111111111111111010 (~5 = -6)

JavaScript koristi 32 bita signed integers
Zato ~5 daje -6

Primer sa 4 bita je unsigned binary numbers
Zato ~5 daje 10

nije greška!
signed integer koriste leftmost bit kao minus znak

5	00000000000000000000000000000101
1	00000000000000000000000000000001
5 & 1	00000000000000000000000000000001 (1)

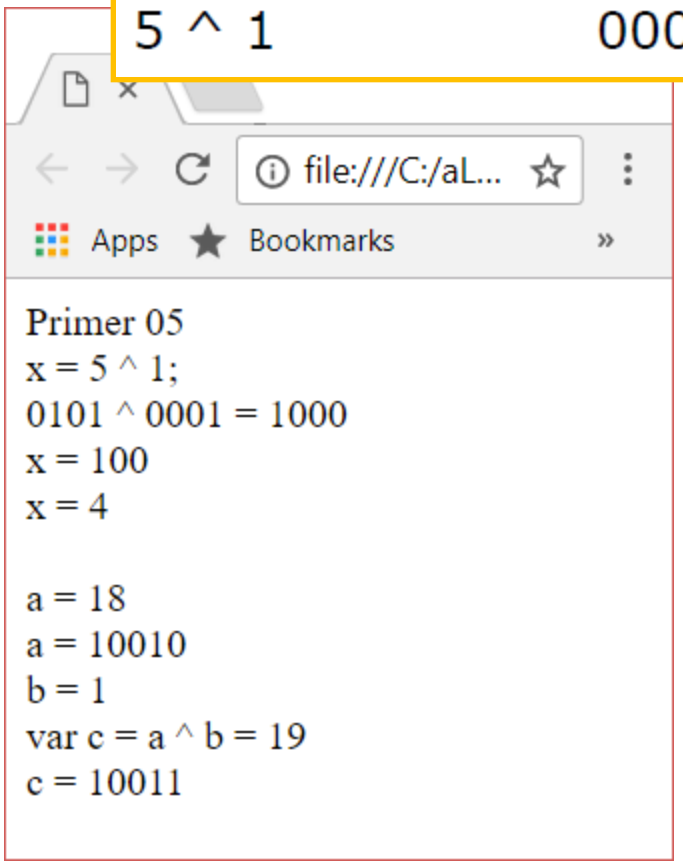
JavaScript Bitwise AND (&)

5	00000000000000000000000000000101
1	00000000000000000000000000000001
5 | 1	00000000000000000000000000000101 (5)

JavaScript Bitwise OR (|)

JavaScript Bitwise XOR (^)

5	00000000000000000000000000000101
1	00000000000000000000000000000001
5 ^ 1	00000000000000000000000000000100 (4)

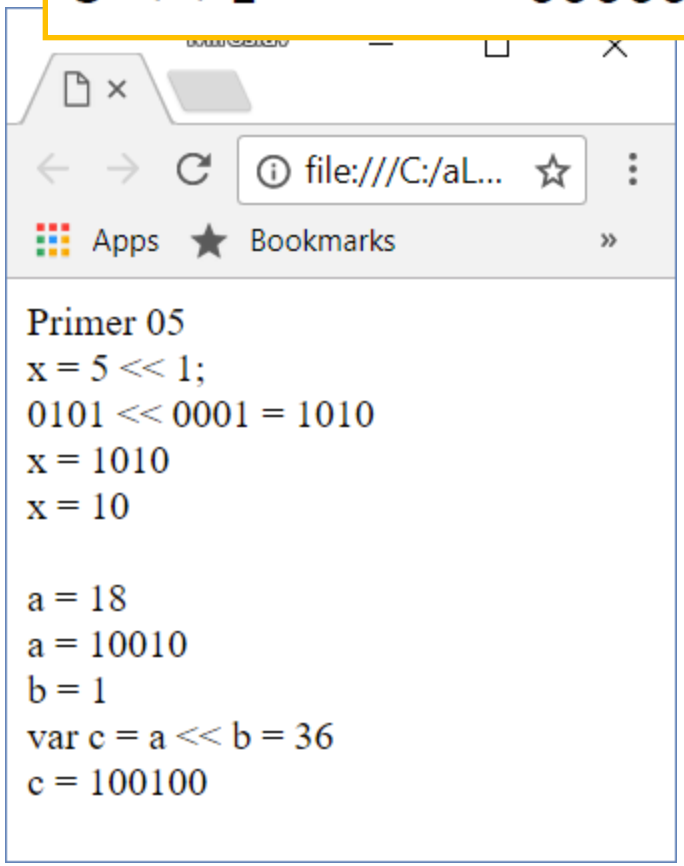



```
var x = 5 ^ 1;
document.write("Primer 05");
document.write("<br>x = 5 ^ 1;");
document.write("<br>0101 ^ 0001 = 0100 ");
document.write("<br>x = ",x.toString(2));
document.write("<br>x = ",x);

var a = 18;
document.write("<br><br>a = ",a);
document.write("<br>a = ",a.toString(2));
var b = 1;
document.write("<br>b = ",b.toString(2));
var c = a ^ b;
document.write("<br>var c = a ^ b = ",c);
document.write("<br>c = ",c.toString(2));
```

Ln 4 : 16 Col 36 Sel 0 | 449 Bytes | ANSI | CR+LF | INS | Ja

JavaScript (Zero Fill) Bitwise Left Shift (<<)

5	00000000000000000000000000000101
5 << 1	00000000000000000000000000001010 (10)

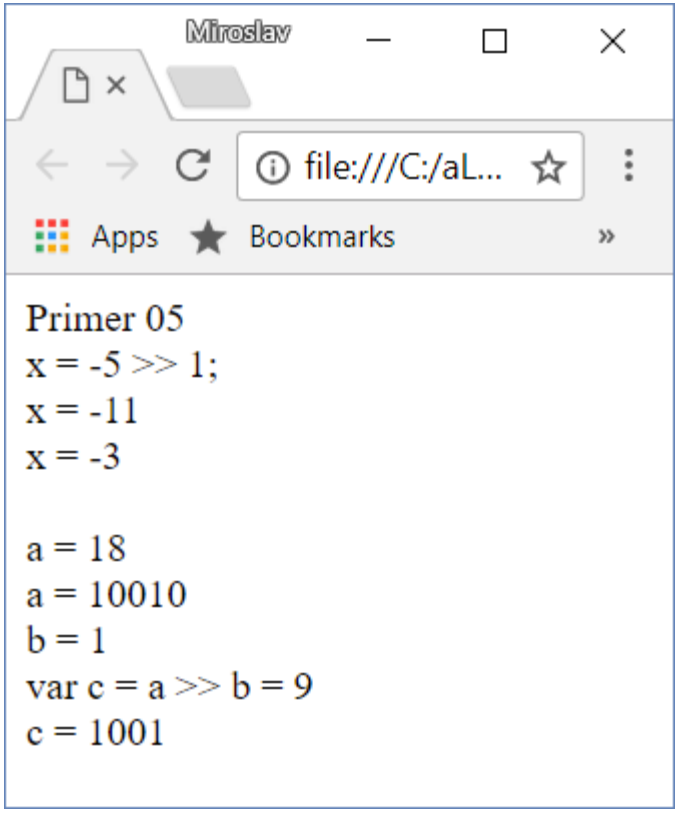



```
var x = 5 << 1;
document.write("Primer 05");
document.write("<br>x = 5 << 1;");
document.write("<br>0101 << 0001 = 1010 ");
document.write("<br>x = ",x.toString(2));
document.write("<br>x = ",x);

var a = 18;
document.write("<br><br>a = ",a);
document.write("<br>a = ",a.toString(2));
var b = 1;
document.write("<br>b = ",b.toString(2));
var c = a << b;
document.write("<br>var c = a << b = ",c);
document.write("<br>c = ",c.toString(2));
```

Ln 4 : 16 Col 39 Sel 0 | 454 Bytes | ANSI | CR+LF | INS | Java

JavaScript (Sign Preserving) Bitwise Right Shift (>>)

-5	11111111111111111111111111111011
-5 >> 1	11111111111111111111111111111101 (-3)

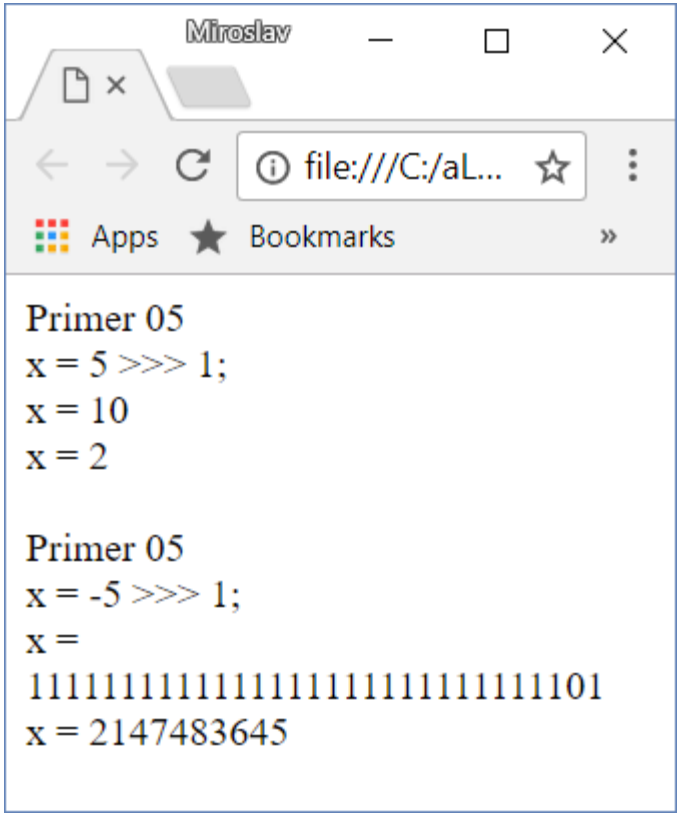


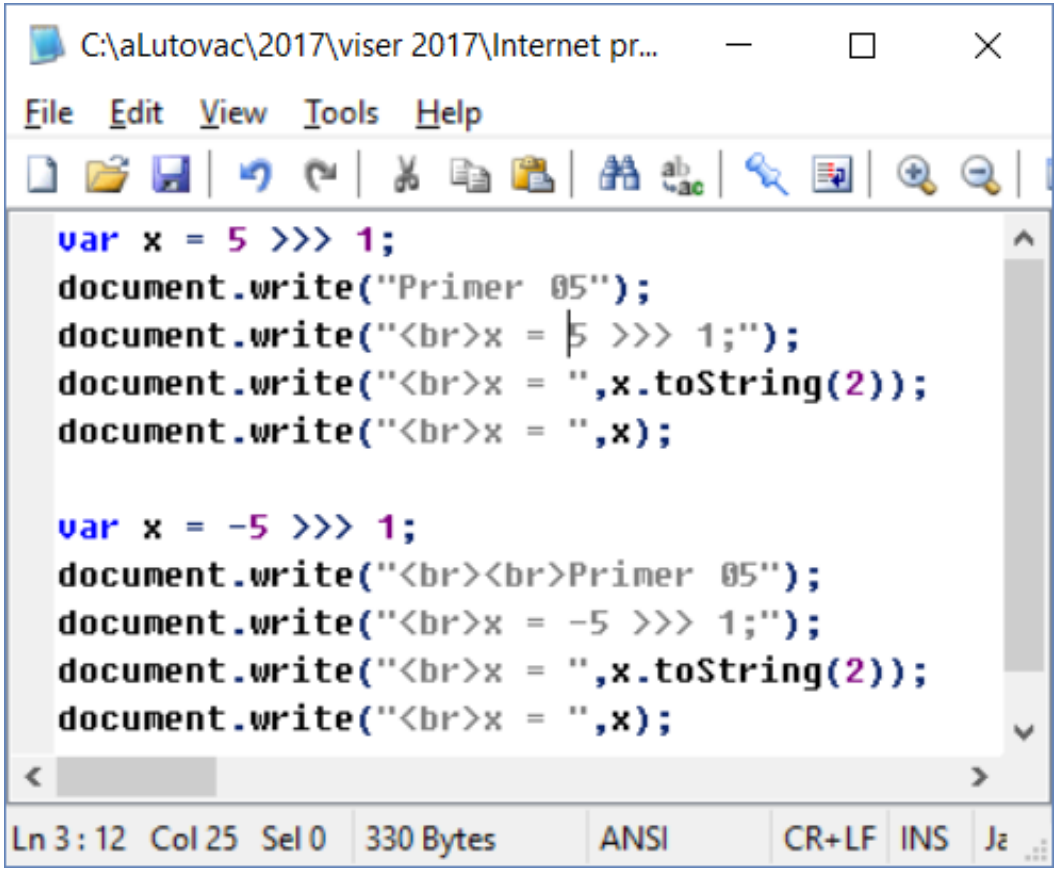

```
var x = -5 >> 1;
document.write("Primer 05");
document.write("<br>x = -5 >> 1;");
document.write("<br>x = ",x.toString(2));
document.write("<br>x = ",x);

var a = 18;
document.write("<br><br>a = ",a);
document.write("<br>a = ",a.toString(2));
var b = 1;
document.write("<br>b = ",b.toString(2));
var c = a >> b;
document.write("<br>var c = a >> b = ",c);
document.write("<br>c = ",c.toString(2));
```

Ln 4 : 15 Col 1 Sel 0 | 411 Bytes | ANSI | CR+LF | INS | Ja

JavaScript (Zero Fill) Right Shift (>>>)

5	00000000000000000000000000000101
5 >>> 1	00000000000000000000000000000010 (2)





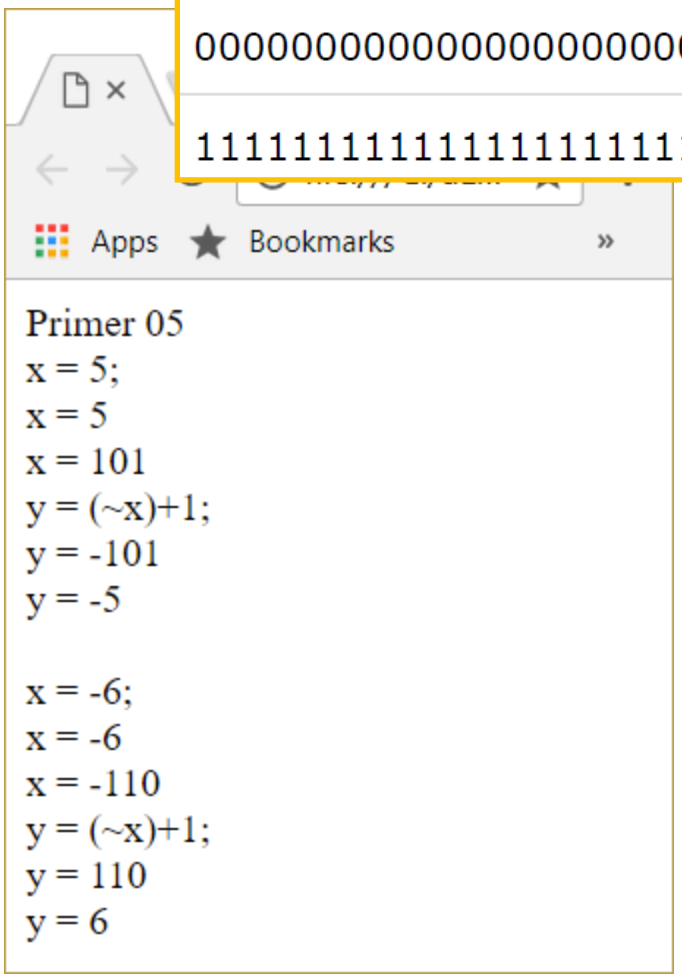
Binary Representation	Decimal value
00000000000000000000000000000001	1
00000000000000000000000000000010	2
00000000000000000000000000000100	4
00000000000000000000000000001000	8
00000000000000000000000000010000	16
00000000000000000000000000100000	32
00000000000000000000000001000000	64

Binary Representation	Decimal value
00000000000000000000000000000101	5 (4 + 1)
00000000000000000000000000001101	13 (8 + 4 + 1)
00000000000000000000000000101101	45 (32 + 8 + 4 + 1)

00000000000000000000000000000101	5
11111111111111111111111111111011	-5
00000000000000000000000000000110	6
11111111111111111111111111111010	-6
00000000000000000000000000101000	40
11111111111111111111111111011000	-40

JavaScript binarni brojevi su u formatu komplementa 2
Negativni brojevi se dobijaju kao NOT svih bitova plus 1

00000000000000000000000000000101	5
11111111111111111111111111111011	-5
00000000000000000000000000000110	6
11111111111111111111111111111010	-6
00000000000000000000000000101000	40
11111111111111111111111111011000	-40




```
var x = 5;
var y = (~x)+1;
document.write("Primer 05");
document.write("<br>x = 5;");
document.write("<br>x = ",x);
document.write("<br>x = ",x.toString(2));
document.write("<br>y = (~x)+1;");
document.write("<br>y = ",y.toString(2));
document.write("<br>y = ",y);

var x = -6;
var y = (~x)+1;
document.write("<br><br>x = -6;");
document.write("<br>x = ",x);
document.write("<br>x = ",x.toString(2));
document.write("<br>y = (~x)+1;");
document.write("<br>y = ",y.toString(2));
document.write("<br>y = ",y);
```

sa 3 bita

Bits	Unsigned value	Two's complement value
011	3	3
010	2	2
001	1	1
000	0	0
111	7	−1
110	6	−2
101	5	−3
100	4	−4

sa 8 bita

Bits	Unsigned value	Two's complement value
0111 1111	127	127
0111 1110	126	126
0000 0010	2	2
0000 0001	1	1
0000 0000	0	0
1111 1111	255	−1
1111 1110	254	−2
1000 0010	130	−126
1000 0001	129	−127
1000 0000	128	−128

JavaScript koristi
32-bit signed brojeve

JavaScript koristi 32-bit signed brojeve

```
var x = 5;
var y = dec2bin(x);
var z = bin2dec(y);

document.write("<br>x = ",x);
document.write("<br>x_bin = ",x.toString(2));
document.write("<br>y = ",y);
document.write("<br>z = ",z);

function dec2bin(dec){
    return (dec >>> 0).toString(2);
}

function bin2dec(bin){
    return parseInt(bin, 2).toString(10);
}
```

Miroslav

file://

Apps Bookmark

x = 5
x_bin = 101
y = 101
z = 5

function

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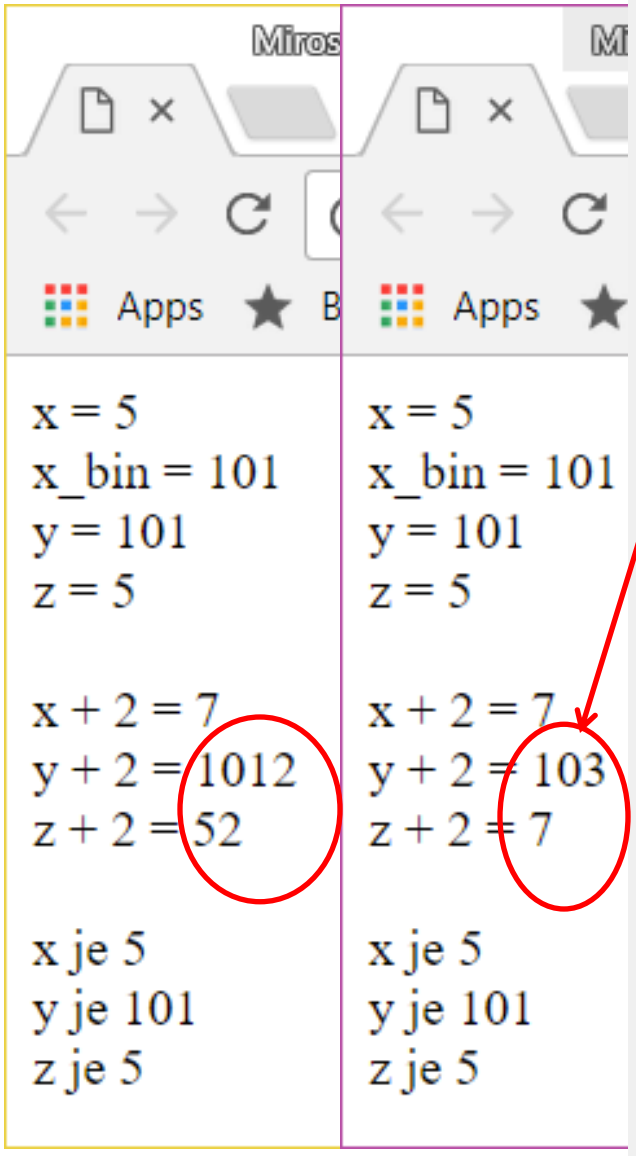
Apps Bookmarks

x = 5
x_bin = 101
y = 101
z = 5

x + 2 = 7
y + 2 = 1012
z + 2 = 52

x je 5
y je 101
z je 5

```
var x = 5;
var y = dec2bin(x);
var z = bin2dec(y);

document.write("x = ",x);
document.write("<br>x_bin = ",x.toString(2));
document.write("<br>y = ",y);
document.write("<br>z = ",z);

document.write("<br><br>x + 2 = ",x+2);
document.write("<br>y + 2 = ",y+2);
document.write("<br>z + 2 = ",z+2);

document.write("<br><br>x je "+x);
document.write("<br>y je "+y);
document.write("<br>z je "+z);


function dec2bin(dec){
    return (dec >>> 0).toString(2);
}

function bin2dec(bin){
    return parseInt(bin, 2).toString(10);
}
```




```
var x = 5;
var y = 1*dec2bin(x);
var z = 1*bin2dec(y);

document.write("x = ",x);
document.write("<br>x_bin = ",x.toString(2));
document.write("<br>y = ",y);
document.write("<br>z = ",z);

document.write("<br><br>x + 2 = ",x+2);
document.write("<br>y + 2 = ",y+2);
document.write("<br>z + 2 = ",z+2);

document.write("<br><br>x je "+x);
document.write("<br>y je "+y);
document.write("<br>z je "+z);


function dec2bin(dec){
    return (dec >>> 0).toString(2);
}

function bin2dec(bin){
    return parseInt(bin, 2).toString(10);
}
```

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File Edit View Tools Help

```
var x = 100 + 50;;
var y = 100 - 50;;
var z = "100" + "50";;
var v = "100" - "50";;
var w = "100 - 50";;

document.write("x = ",x);
document.write("<br>y = ",y);
document.write("<br>z = ",z);
document.write("<br>v = ",v);
document.write("<br>w = ",w);
```

Ln 10 : 12 Col 28 Sel 266 Bytes ANSI

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file:///C:/al

Apps Bookmarks

x = 150
y = 50
z = 10050
v = 50
w = 100 - 50