

# Типове, функции, граматики

25 октомври 2024 г.

# Типове в езиците за програмиране

# Абстрактна необходимост

- Моделиране
- Различни физически характеристики на свойствата на реалните обекти
- Физически и абстрактни свойства (тегло vs. име)

- Авто къща
- Авто морга
- Завод



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# Машинна необходимост

- Обем памет

$$\begin{array}{r}
 127_{10} = \begin{array}{|c|c|c|c|c|c|} \hline 1 & 1 & 1 & 1 & 1 & 1_2 \\ \hline \end{array} \\
 128_{10} = \begin{array}{|c|c|c|c|c|c|} \hline 1 & 0 & 0 & 0 & 0 & 0_2 \\ \hline \end{array}
 \end{array}$$

- Приближено представяне на неизброими типове

$$123.45 = \overbrace{12345}^{\text{мантиса}} * \underbrace{10^{-2}}_{\text{експонента}}$$

- Диапазон (range) vs. точност (precision)
- Как представяме 1/3

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# Примери

```
int main ()
{
    int int_a = 1, int_b = 2;
    double dbl_a = 1, dbl_b = 2;
    char chr_a = 'a', chr_b = 'b';

    cout << int_a / int_b << endl;
    cout << dbl_a / dbl_b << endl;
    cout << chr_a << endl;

    int_a = 'a'; //int_a = chr_a;
    cout << int_a << endl;

    chr_a = 65;
    cout << chr_a << endl;

    return 0;
}
```

# Математическа характеристика

## Множество допустими стойности (Носител - $D$ )

- Мъж, Жена
- 0..255
- $(\mathcal{R}, \mathcal{R}, \mathcal{R})$

## Операции

- $f : D \times D \rightarrow D$
- $f(x, y) = x + y$

## Предикати

- $p : D \rightarrow \{tt, ff\}$
- $p(x) = |x|_2 == 0$

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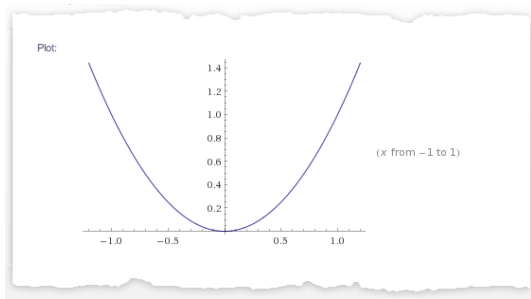
## Функции. Подпрограми



# Функции в математиката

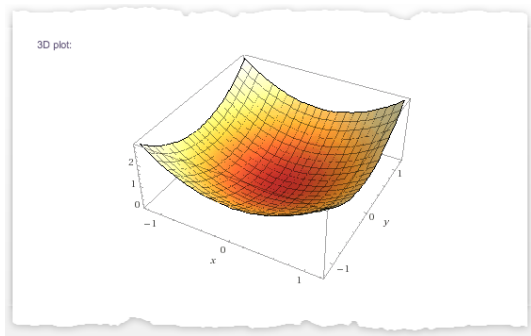
- Дефиниционна област (Domain)
- Множество на стойностите (Range)
- $f : \text{Domain} \rightarrow \text{Range}$

$$f(x) = x^2$$

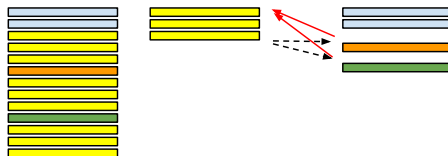


# Функции в математиката

$$f(x, y) = x^2 + y^2$$



# Подпрограми



# Лице на триъгълник по три страни

$$a, b, c \in \mathcal{R}$$

$$S = \sqrt{\frac{a+b+c}{2} \frac{b+c-a}{2} \frac{a+c-b}{2} \frac{a+b-c}{2}} = \sqrt{p(p-a)(p-b)(p-c)} \in \mathcal{R}$$

$$s : \mathcal{R} \times \mathcal{R} \times \mathcal{R} \rightarrow \mathcal{R}$$

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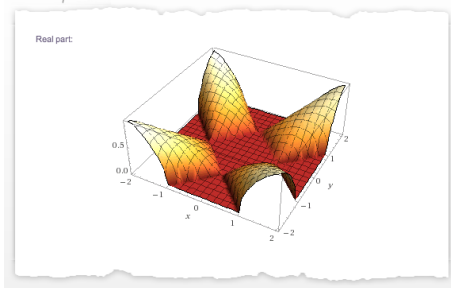
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# Съответната функция

$$s : \mathcal{R} \times \mathcal{R} \times \mathcal{R} \rightarrow \mathcal{R}$$

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# Съответната подпрограма

$$s : \mathcal{R} \times \mathcal{R} \times \mathcal{R} \rightarrow \mathcal{R}$$
$$s(a, b, c) = \sqrt{p(p-a)(p-b)(p-c)}$$

```
double triangleSurface (double a, double b, double c)

{
    double p = (a+b+c)/2;
    double surface = sqrt (p*(p-a)*(p-b)*(p-c));

    return surface;
}
```



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    double surface = sqrt (p*(p-a)*(p-b)*(p-c));

    return surface;
}
```

# Програма - потребител

```
int main ()
{
    double a,b,c,a1,b1,c1;

    cout << "Sides_of_ABC:";
    cin >> a >> b >> c;
    cout << "Sides_of_DEF:"
    cin >> a1 >> b1 >> c1;

    if (triangleSurface(a,b,c) < triangleSurface (a1,b1,c1))
    {
        cout << "Yes,_ABC_takes_less_space!" << endl;
    } else {
        cout << "No,_ABC_does_not_take_less_space!" << endl;
    }

    return 0;
}
```

# Вградени числови функции

```
#include <cmath>
```

- `abs(x)`, `fabs(x)`
- `sin(x)`, `cos(x)`, `tan(x)`, `asin(x)`, `acos(x)`, `atan(x)` `exp(x)`, `log(x)`, `log10(x)`
- `ceil(x)`, `floor(x)`
- `sqrt(x)`, `pow(x, n)`

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## Съвсем малко теория

# Формални граматики

the cat meows.

the dog barks at the cat.

the student lies to the teacher.

- Азбука:  $\Sigma = \{a..z\}$
- Нетерминални символи: **{Verb, Object, Subject, Prep, Sentence}**
- Продукционни правила:

**Object**  $\rightarrow cat|dog|student$

**Subject**  $\rightarrow cat|dog|teacher$

**Verb**  $\rightarrow meows|barks|lies$

**Prep**  $\rightarrow to|at$

**Sentence**  $\rightarrow the \quad \text{Object} \quad \text{Verb}$

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**Prep**  $\rightarrow$  *to|at*

**Sentence**  $\rightarrow$  *the* **Object** **Verb**

**Sentence**  $\rightarrow$  *the* **Object** **Verb** **Prep** *the* **Subject**



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**Sentence**  $\rightarrow$  *the*   **Object**   **Verb**

**Sentence**  $\rightarrow$  *the*   **Object**   **Verb**   **Prep**   *the*   **Subject**

# Извод на the cat meows at the dog

Object → cat|dog|student

Subject → cat|teacher

Verb → meows|barks|lies

Prep → to|at

Sentence → the    Object   Verb   Prep   the   Subject  
 the   the   the   the   the   the

Sentence → the   Object   Verb   Prep   the   Subject

Object → cat

Sentence → the   cat   Verb   Prep   the   Subject

Verb → meows

Sentence → the   cat   meows   Prep   the   Subject

Prep → at

Sentence → the   cat   meows   at   the   Subject

Subject → dog

Sentence → the   cat   meows   at   the   dog

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Object → cat|dog|student

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Verb → meows|barks|lies

Prep → to|at

Sentence → the    Object   Verb   Prep   the   Subject

**Sentence** → the   **Object**   **Verb**   **Prep**   the   **Subject**

Object → cat

Sentence → the   cat   Verb   Prep   the   Subject

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Verb → meows|barks|lies

Prep → to|at

Sentence → the Object Verb

Sentence → the Object Verb Prep the Subject

Sentence → the Object Verb Prep the Subject

Object → cat

Sentence → the cat Verb Prep the Subject

Verb → meows

Sentence → the cat meows Prep the Subject

Prep → at

Sentence → the cat meows at the Subject

Subject → dog

Sentence → the cat meows at the dog

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 Verb → meows|barks|lies  
 Prep → to|at  
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Sentence → the    Object   Verb   Prep   the   Subject

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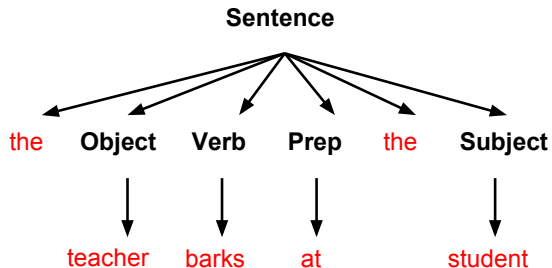
Prep → at

Sentence → the    cat   meows   at   the   Subject

Subject → dog

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# Синтактично дърво





# Мета-език на Бекус-Наур

- $\langle \textit{digit} \rangle ::= 0|1|2|3|4|5|6|7|8|9$
- $\langle \textit{unsignedint} \rangle ::= \langle \textit{digit} \rangle^+$
- $\langle \textit{integer} \rangle ::= [+|-] \langle \textit{unsignedint} \rangle$
- $\langle \textit{identifier} \rangle ::= \_ (\langle \textit{letter} \rangle | \langle \textit{digit} \rangle | \_)^*$
- $\langle \textit{identifier} \rangle ::= \langle \textit{leter} \rangle (\langle \textit{letter} \rangle | \langle \textit{digit} \rangle | \_)^*$