Ukazni programski jezik

24. 2. 2025

Jezik: . Cela števila + × = <
· boolovi izrazi : true, false, ∧ , ∨ , ¬
· if –then– else , while , spremenljivke

```
⟨aritmetični-izraz⟩ ::=
  ⟨spremenljivka⟩ |
  ⟨številka⟩
  ⟨aritmetični-izraz⟩ + ⟨aritmetični-izraz⟩ |
→ ⟨aritmetični-izraz⟩ * ⟨aritmetični-izraz⟩
```

dvoumna
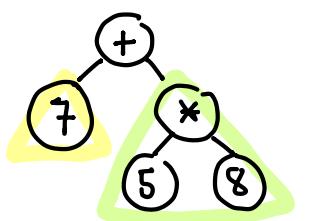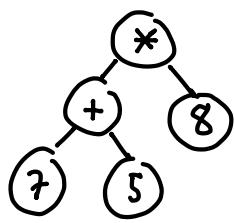
Določimo
· prioriteto (kateri ima prednost)
· asociativnost
  operatorjev :
    levo, desno, nič

7 + 5 * 8

$7 + 5 + 8$

$(x + y) + z \stackrel{?}{=} x + (y + z)$
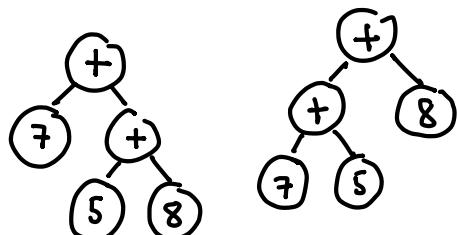
$7 - 5 - 8$ $(7 - 5) - 8 = -6$
$7 - (5 - 8) = 10$

levo ⁎ ; $a ⁎ b ⁎ c = (a ⁎ b) ⁎ c$ + ~ ⁎
desno ⁎ : $a ⁎ b ⁎ c = a ⁎ (b ⁎ c)$ $a^{b^c} = a^{(b^c)}$ ∧
nič ⁎ : ⟺ $a \char`^ b \char`^ c$

$(p ⟺ q) ⟺ r$

$$x + 2y = 0 \iff x = -2y \iff \frac{x}{2} = -y \qquad \text{te tri izjave}$$
$$\text{so ekvivalentne}$$

$$(x + 2y = 0 \iff x = -2y) \iff \frac{x}{2} = -y$$
$$\underset{\text{true}}{} \qquad \iff \frac{x}{2} = -y$$
$$\frac{x}{2} = -y$$

Veliki koraki: $\quad \eta \mid e \hookrightarrow n$

$$\underset{\text{izraz}}{\uparrow} \qquad \underset{\text{vrednost}}{\nwarrow}$$

Mali koraki: $\quad \eta \mid e \mapsto e'$

$$\underset{\text{izraz}}{\uparrow} \qquad \underset{\text{izraz}}{\uparrow}$$

Kratkostična konjunkija

$$\frac{\eta \mid b_1 \hookrightarrow \text{false}}{\eta \mid b_1 \text{ and } b_2 \hookrightarrow \text{false}}$$

$$\frac{\eta \mid b_1 \hookrightarrow \text{true} \qquad \eta \mid b_2 \hookrightarrow v_2}{\eta \mid b_1 \text{ and } b_2 \hookrightarrow v_2}$$

$$v_1, v_2 \in \{\text{false}, \text{true}\}$$

Dolgostična konjunkcije

$$\frac{\eta \mid b_1 \hookrightarrow v_1 \qquad \eta \mid b_2 \hookrightarrow v_2}{\eta \mid b_1 \text{ and } b_2 \hookrightarrow v_1 \wedge v_2}$$

$$\frac{\text{if } (i < a.\text{length} \ \&\& \ a[i] > 0) \ \{ \ldots \ldots \}}{\text{if } (f(7) \ \&\& \ g(8)) \ \{ \ldots \checkmark \}}$$

$$\Downarrow$$

najprej $b_1 = f(7)$;
potem $b_2 = g(8)$;
$\qquad \text{if } (b_1 \ \&\& \ b_2) \ \{ \ldots \}$

while (i++ < n) { ...... }

Primer izvajanja programa:

$([x \mapsto 6], (\text{while } \underbrace{x < 7}_{\text{true}} \text{ do } x := x+1 \text{ done})) \mapsto$

$([x \mapsto 6], (\underbrace{x := x+1}; \text{while } x < 7 \text{ do } x := x+1 \text{ done})) \mapsto$

$([x \mapsto 6], x := x+1) \mapsto ([x \mapsto 7], \text{skip})$

$([x \mapsto 7], (\text{skip}; \text{while } x < 7 \text{ do } x := x+1 \text{ done})) \mapsto$

$([x \mapsto 7], (\qquad \text{while } \underbrace{x < 7}_{\text{false}} \text{ do } x := x+1 \text{ done})) \mapsto$

$([x \mapsto 7], \text{skip})$

$[\![3 + 8]\!]$ denotacija / pomen izraza $\underbrace{3+8}$
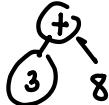
"3 + 8"

$[\![(x := 3; y := x+8)]\!]$

$[\![x + 3]\!] : \text{Env} \to \mathbb{Z}$

$[\![x]\!] \eta$

$\leadsto$
$$[\![e_1 = e_2]\!](\eta) = ([\![e_1]\!](\eta) = [\![e_2]\!](\eta))$$
$$[\![e_1 < e_2]\!](\eta) = ([\![e_1]\!](\eta) < [\![e_2]\!](\eta))$$

znak manjše ↑   celo št. ⎵   ↑ mat. relacij. manjše   celo št. ⎵

$$\underbrace{\qquad\qquad}_{\perp \text{ ali } \top}$$

$\rightarrow$ $[\![e_1 < e_2]\!](\eta) = \begin{cases} \top & \text{če } [\![e_1]\!](\eta) < [\![e_2]\!](\eta) \\ \perp & \text{sicer} \end{cases}$ NOOBSKO

if (p) { return true;} else { return false;} NOOBSKO
OKROG RITI V ŽEP

$\Downarrow$

return p;

$[\![\text{while } b \text{ do } c \text{ done}]\!](\eta) = \begin{cases} \eta & \text{če } [\![b]\!](\eta) = \perp \\ \\ [\![c; \text{while } b \text{ do } c \text{ done}]\!](\eta) & \text{sicer} \end{cases}$

$$\overset{"}{[\![\text{while } b \text{ do } c \text{ done}]\!] \big([\![c]\!](\eta) \big)}$$

Ciklična / rekurzivna definicija

C evalvacijski kontekst

lukrje v kodi

C[ ]