

NASP - 1.MI - 2014/12

① $n=8$ $p=0.5$

$$h \leq 1 + \log_2 n = 1 + \log_2 8 = 1 + 3 = 4$$

$$E(n) = n \cdot p^{k-1} \cdot (1-p)$$

$$E(n_1) = 8 \cdot \left(\frac{1}{2}\right)^0 \cdot \frac{1}{2} = 4$$

$$E(n_2) = 8 \cdot \left(\frac{1}{2}\right)^1 \cdot \frac{1}{2} = 2$$

$$E(n_3) = 8 \cdot \left(\frac{1}{2}\right)^2 \cdot \frac{1}{2} = 1$$

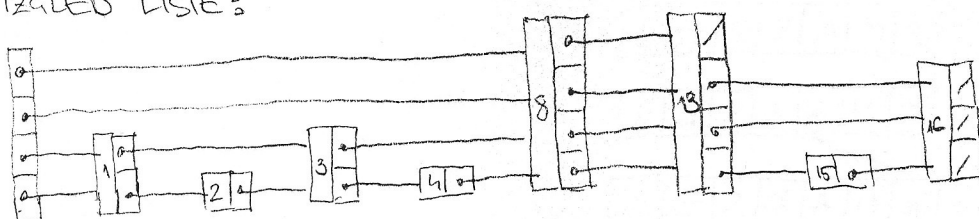
$$E(n_4) = 8 \cdot \left(\frac{1}{2}\right)^3 \cdot \frac{1}{2} = \frac{1}{2} \Rightarrow 1$$

PRETINACI

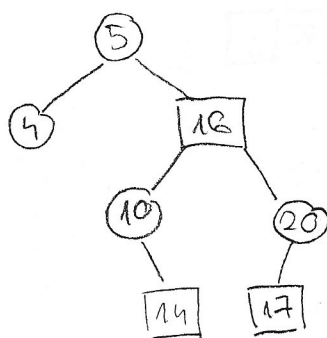
$[0, 4>$, $[4, 6>$, $[6, 7>$, $[7, 8>$ (i) $[0, 0.5>$, $[0.5, 0.75>$, $[0.75, 0.875>$, $[0.875, 1>$

VJERJATNOST	0.81	0.99	0.65	0.91	0.68	0.42	0.09	0.18	0.3
BROJ	12	8	3	13	1	15	2	4	3
PRETINACI	8	4	2	4	2	1	1	1	1

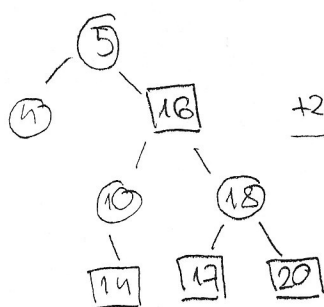
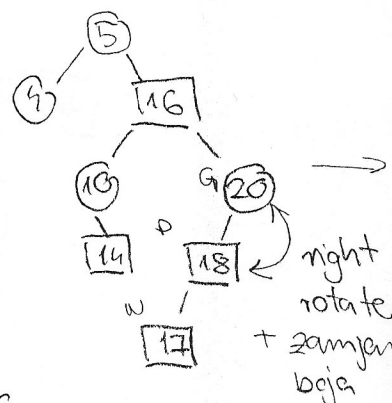
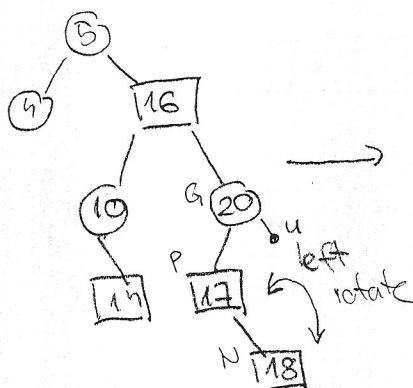
IZGLEDE LISTE:



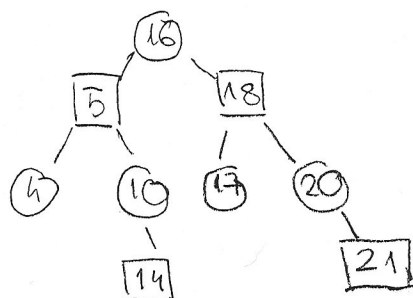
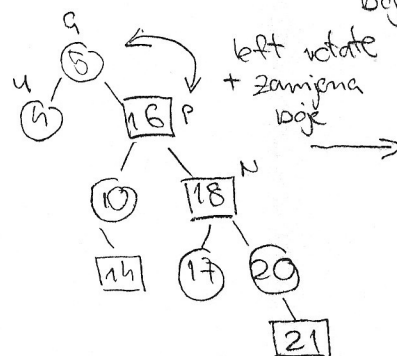
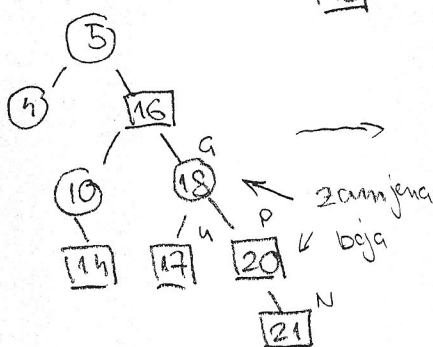
②



+18



+21



✓

③. BNode:

int keyNum - broj ključeva koje čvor sadrži

int[] keys - polje ključeva

BNode[] pointers - polje pokazivača na djecu

SearchBTree(Node node, int key)

if (node == 0) {
 return null;
}

else {

for (i = 1; i <= node.keyNum && node.keys[i] < key; i++);

if (i > node.keyNum || node.keys[i] > key)

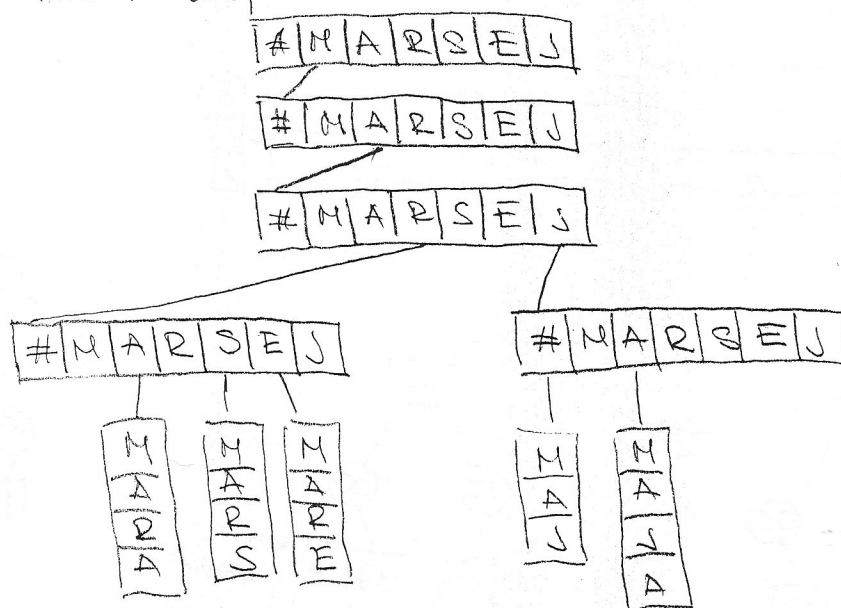
 SearchBTree (node.pointers[i];

else

 return node;

}

④. TRIE



NASP - 1. MI, 2011/12 (2) GENETSKI ALGORITMI ✓

⑤

jedinka	10110	01111	10101	10111	00001
dobrota	66	39	27	15	3

Prikaži proces stvaranja 2 nove jedinke

- jednostavni razmjerni odabir
- križanje s jednom prekidnom tačkom
- mutacija mijenja gen na bgi se odnosi

$P_k = 0.8$
 Vrijednost križanja
 $P_m = 0.1$
 Vrijed. mutacije

RANDOM: 0.2, 0.84, 0.05, 0.41, 0.22, 0.62, 0.21, 0.19, 0.44, 0.36, 0.54, 0.76, 0.48, 0.01

1) ODABIR JEDINKE ZA KRIŽANJE

10110	01111	10101	10111	00001
66/150	39/150	27/150	15/150	3/150
0.44	0.26	0.18	0.1	0.02

$[0, 0.44>$ $[0.44, 0.7>$ $[0.7, 0.88>$ $[0.88, 0.98>$ $[0.98, 1>$

$0.2 \rightarrow p_1$ 10110
 $0.84 \rightarrow p_3$ 10101

2) ODLUKA O KRIŽANJU

$0.05 \rightarrow$ križanja će biti $0.05 < 0.8$

3) ODABIR TOČKE PREKIDA (4 MOGUĆNOSTI)

{ gen g_1 | g_2 | g_3 | g_4 | g_5 } ODAKLE OVI BROJEVI?

$[0, 0.25>$ $[0.25, 0.5>$ $[0.5, 0.75>$ $[0.75, 1>$

$P_w = 0.41 \rightarrow$ između g_2 i g_3

4) KRIŽANJE

$10110 \rightarrow 10101$
 $10101 \rightarrow 10110$

5) MUTACIJA $w_i < P_m$

①

1	0	1	0	1
0.22	0.62	0.21	0.19	0.44
1	0	1	0	1

②

1	0	1	1	0
0.06	0.54	0.76	0.48	0.01
0	0	1	1	1

MUTIRANE JEDINKE

10101
 00111

6) IZLAZ

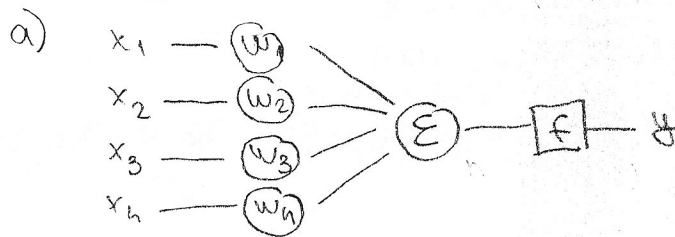
10101
 00111

6)

	ulaz1	ulaz2	ulaz3	ulaz4	izlaz
1)	1	0	0	0	1
2)	0	0	0	1	1
3)	0	0	1	0	0
4)	0	1	0	0	0

LINEARNI NEURON ADALINE.

$$x_d = \begin{bmatrix} 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 1 \\ 0 & 0 & 1 & 0 \\ 0 & 1 & 0 & 0 \end{bmatrix} = x_d^T \quad y_d = \begin{bmatrix} 1 \\ 1 \\ 0 \\ 0 \end{bmatrix}$$



b) $p = n = 4$
 rješanje je jedinstveno
 ako ga ima

c)

$$x_d^T \cdot w = y_d \Rightarrow w = (x_d x_d^T)^{-1} x_d y_d$$

$$x_d \cdot x_d^T = \begin{bmatrix} 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 1 \\ 0 & 0 & 1 & 0 \\ 0 & 1 & 0 & 0 \end{bmatrix} \cdot \begin{bmatrix} 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 1 \\ 0 & 0 & 1 & 0 \\ 0 & 1 & 0 & 0 \end{bmatrix} = \begin{bmatrix} 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 1 \\ 0 & 0 & 1 & 0 \\ 0 & 1 & 0 & 0 \end{bmatrix}$$

$$\begin{array}{c|c} x_d x_d^T & I \\ \hline \begin{bmatrix} 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 1 \\ 0 & 0 & 1 & 0 \\ 0 & 1 & 0 & 0 \end{bmatrix} & \begin{bmatrix} 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix} \end{array} \sim \begin{array}{c|c} I & (y_d y_d^T) \\ \hline \begin{bmatrix} 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix} & \begin{bmatrix} 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 1 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 0 \end{bmatrix} \end{array}$$

$$(x_d x_d^T)^{-1} x_d = x_d \quad w = (x_d x_d^T)^{-1} x_d \cdot y_d = \begin{bmatrix} 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 1 \\ 0 & 0 & 1 & 0 \\ 0 & 1 & 0 & 0 \end{bmatrix}_{4 \times 4} \begin{bmatrix} 1 \\ 1 \\ 0 \\ 0 \end{bmatrix}_{4 \times 1} = \begin{bmatrix} 1 \\ 0 \\ 0 \\ 1 \end{bmatrix} \Rightarrow w = \begin{bmatrix} 1 \\ 0 \\ 0 \\ 1 \end{bmatrix}$$

d) $w^{(0)} = \begin{bmatrix} 0 \\ 0 \\ 0 \\ 0 \end{bmatrix} \quad \alpha_k = 1$

$$k=0: e^{(0)} = x_d^T \cdot w^{(0)} - y_1 = [1 \ 0 \ 0 \ 0] \cdot \begin{bmatrix} 0 \\ 0 \\ 0 \\ 0 \end{bmatrix} - 1 = -1$$

$$w^{(1)} = w^{(0)} - \alpha_k x_1 e^{(0)} \quad 1 \times 4$$

$$= [0 \ 0 \ 0 \ 0]^T - 1 \cdot [1 \ 0 \ 0 \ 0]^T \cdot (-1) = [0 \ 0 \ 0 \ 0]^T + [1 \ 0 \ 0 \ 0]^T = \begin{bmatrix} 1 \\ 0 \\ 0 \\ 0 \end{bmatrix}$$

$$k=1: e^{(1)} = x_d^T \cdot w^{(1)} - y_2 = [0 \ 0 \ 0 \ 1] \cdot \begin{bmatrix} 1 \\ 0 \\ 0 \\ 0 \end{bmatrix} - 1 = -1$$

$$w^{(2)} = w^{(1)} - \alpha_k x_2 e^{(1)} = \begin{bmatrix} 1 \\ 0 \\ 0 \\ 0 \end{bmatrix} - 1 \cdot \begin{bmatrix} 0 \\ 0 \\ 0 \\ 1 \end{bmatrix} \cdot (-1) = \begin{bmatrix} 1 \\ 0 \\ 0 \\ 1 \end{bmatrix}$$

$$k=2: e^{(2)} = x_d^T \cdot w^{(2)} - y_3 = [0 \ 0 \ 1 \ 0] \cdot \begin{bmatrix} 1 \\ 0 \\ 0 \\ 1 \end{bmatrix} - 0 = 0$$

$$w^{(3)} = w^{(2)}$$