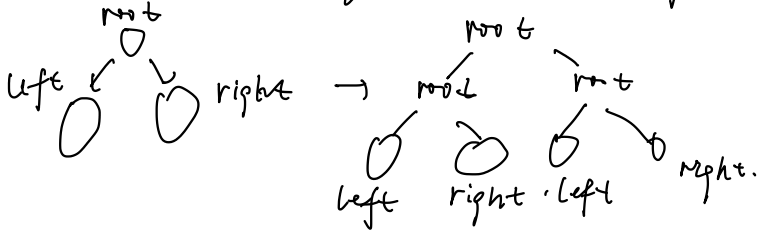
IS18

2022年5月23日星期一 18:16

Q1 (a)

(1) pre + in : Yes

By pre-order sequence. we can know the root (1st node), then in-order sequence shows the left and right sub-tree.



In this way, we can fininally reconstruct the whole tree

(2) post + In : Yes

The same as pre+in, we can use post-order sequence to know the root, then use in-order sequence to diviede left and right sub-tree.

(3) pre + post : No

E.g. pre-order : AB
post-order : BA

Note: pre+post is ok if tree is full tree

(b) maxDist (Node) {

```
distAndDepth(node) {
    if empty(node):
        return 0,0
    L_dep, L_dist = distAndDepth(node->left)
    r_dep, r_dist= distAndDepth(node_right)
    dist = L_dep + r_dep
    max_dist={L_dist, r_dist, dist}
    max_depth={L_depth, r_depth}
return max_depth+1, max_dist

return max_dist
```

Q2 (a.i) $2^{32} = 4GB$

(a.ii) 2^{16} frames, 2^{32} address => frame size 2^{16} => 16-bit offset

256 entries => 8-bit page numbers

logic addr. = page numb + offset = 16+8 = 24-bit //

(a.iii) Logical : D3E2F7

page # → $(211)_{10}$ → by table ↓ $(EAC3)_{16}$

offset

∴ physical addr. 0xEAC3E2F7 //

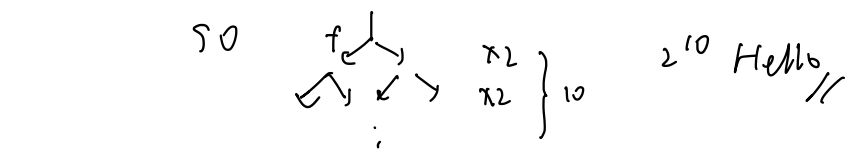
(a.iv) physical : A89C78C2

page #: 111 → $(6F)_{16}$ → Logical : 0x6F78C2 //

offset

(b) Note: fork() function in Unix.

1. Copy itself, start a subprocess
2. parent process return subprocess ID
   subprocess return 0;



(c)

	1	3	2	3	4	1	5	2	5	6
FIFO:	1	1	1	1	4	4	4	2	2	2
		3	3	3	3	1	1	1	1	6
			2	2	2	2	5	5	5	5
	F	F	F		F	F	F	F		F

8 page fauts.

	1	3	2	3	4	1	5	2	5	6
LRU	1	1	1	1	4	4	4	2	2	2
		3	3	3	3	3	5	5	5	5
			2	2	2	1	1	1	1	6
	F	F	F		F	F	F	F		F

8 page faults.

Q3 (a) R: $10B \times 3 \times 18000 = 540000\ B$ $540000/3000 = 180$ pages

S: $10B \times 3 \times 48000 = 1440000\ B$ $1440000/3000 = 480$ pages

(b) Heigh of B^+ tree: $\log_{\frac{n}{2}}(k) = \log_{\frac{20}{2}}(18000) = 5$

① if B is a primal index

# of block trans: $h + b = 5 + 10 = 15$

(h: height, b: target records)

# of seeks: $h+1 = 5+1 = 6$

② if B is a secondary index:

# of block trans: $h+b = 5+10 = 15$

# of seeks: $h+b = 15$

(c) unsolved!

(d) unsolved!

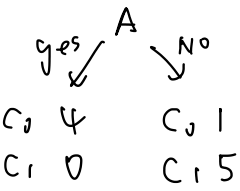
Q4

(a) Before Splitting:

+ →	C_0	5
- →	C_1	5

Gini $= 1 - \frac{1}{4} - \frac{1}{4} = \frac{1}{2}$

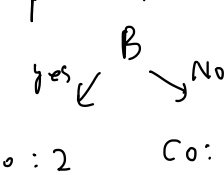
split A:



$GINI_{split A} = \frac{4}{10}(1-0-1) + \frac{6}{10}(1-\frac{1}{6^2}-\frac{5^2}{6^2}) = \frac{1}{6}$

$Gain = \frac{1}{2} - \frac{1}{6} = \frac{1}{3}$

Split B:

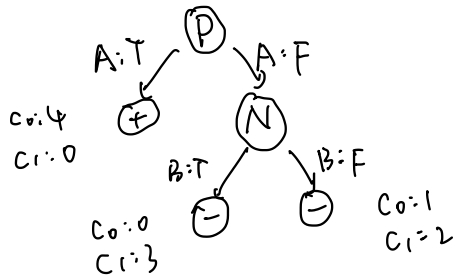


$GINI_{split B} = \frac{1}{2}(1-\frac{2^2}{5^2}-\frac{3^2}{5^2}) + \frac{1}{2}(1-\frac{2^2}{5^2}-\frac{3^2}{5^2}) = \frac{12}{25}$

$Gain = \frac{1}{2} - \frac{12}{25} = \frac{1}{50}$

So should use A as the first splitting $C \frac{1}{3} > \frac{1}{50}$

(b)



(c)

	predict	Couble
T T	+	+
T T	+	+
F T	-	-
T F	+	+
T F	+	+
F T	-	-
F T	-	-
F F	-	+
F F	-	-
F F	-	-

	Pred	
	+	-
actual +	4	1
actual -	0	5

confusion matrix

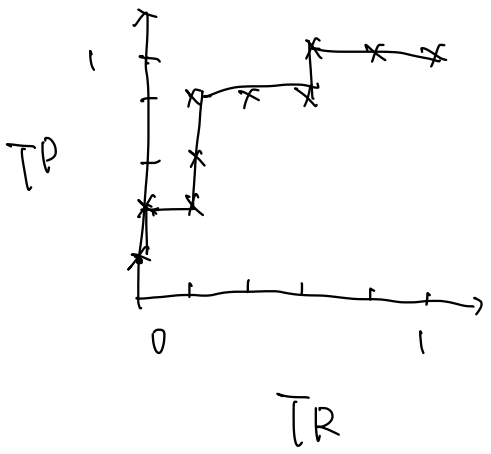
Accuracy = $\frac{9}{10}$ recall = $\frac{4}{5}$

precision = 1 $F1 = \frac{2P \cdot R}{P+R} = \frac{\frac{8}{5}}{\frac{9}{5}} = \frac{8}{9}$

(d)

	Threshold 0.90	0.85	0.82	0.80	0.75	0.70	0.50	0.45	0.40	0.35
T	+	+	+	+	+	+	+	+	+	+
+	-	+	+	+	+	+	+	+	+	+
-	-	-	+	+	+	+	+	+	+	+
+	-	-	-	-	+	+	+	+	+	+
+	-	-	-	-	-	+	+	+	+	+
-	-	-	-	-	-	-	+	+	+	+
+	-	-	-	-	-	-	-	+	+	+
-	-	-	-	-	-	-	-	-	+	+
-	-	-	-	-	-	-	-	-	-	+
-	-	-	-	-	-	-	-	-	-	-

TP	$\frac{1}{5}$	$\frac{2}{5}$	$\frac{2}{5}$	$\frac{3}{5}$	$\frac{3}{5}$	$\frac{3}{5}$	$\frac{3}{5}$	1	1	1
FP	0	0	$\frac{1}{5}$	$\frac{1}{5}$	$\frac{1}{5}$	$\frac{2}{5}$	$\frac{3}{5}$	$\frac{3}{5}$	$\frac{4}{5}$	1



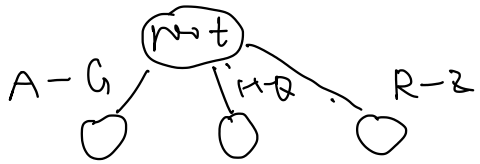
AUC = 0.8

Q5 (a) 1: <3> 3: <2>

(b) (See book)

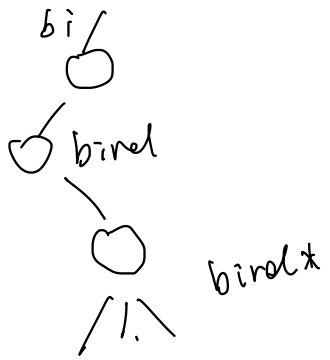
(d)

1. build a B-tree like:



where the leaf or inner nodes, complete words, splitted by sub

Then to find bird*, we can th the sub-tree with "bird" root.



or Reverse B-tree

(c) TrainRocchio(C, D)

for each $c_j \in C$

do $D_j \leftarrow \{d_i : \langle d, c_j \rangle \in D\}$ # Samples of class j

$\mu_j \leftarrow \frac{1}{|D_j|} \sum_{d \in D_j} \vec{v}(d)$ # centor of samples

return $\{\mu_1 \cdots \mu_j\}$

TestRocchio($\mu_1 \cdots \mu_j | d$)

return $\arg\min_j \cos(\mu_j, \vec{v}(d))$ # nearest centor