COMP 251
MIDTERM II
PROTOTYPE

SCORE

YOUR NAME
LUC DEVROYE

YOUR ID.

QUESTION 1

(i) ABDEFC

(ii) DFEBCA

(iii) DBFEAC

(iv) B

(v) 110110 0010

QUESTION 2

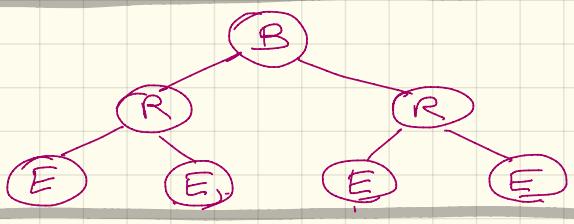
SELECT (R, t):
$x \leftarrow t$, $\ell \leftarrow k$
repeat forever: if left[x] = nil then $r \leftarrow 1$
else $r \leftarrow 1 + \text{SIZE}[\text{left}[x]]$
case $\ell < r$: $x \leftarrow$ left[x]
$\ell = r$: return Key[x] and exit
$\ell > r$: $\ell \leftarrow \ell - r$
$x \leftarrow$ right[x]

QUESTION 3

SMALLEST (R, t): We use an auxiliary binary heap H
MAKENULL (H)
INSERT (R, H)
repeat k times:
$x \leftarrow$ DELETEMIN (H)
if left[x] ≠ nil then INSERT (left[x], H)
if right[x] ≠ nil then INSERT (right[x], H)
output Key[x]

Note: At any point in time, $|H| \leq R + 1$.

QUESTION 4



QUESTION 5

CHECK(t, x, y): Let MIN(t), MAX(t) find the minimum and maximum key in the subtree of t.

If y = MAX(left[x]) or MIN(right[x]) or x = MAX(left[y]) or MIN(right[y])

then return "true"

else return "false"

QUESTION 6

XXX: $e < max[left[t]]$

YYY: "flo"

ZZZ: contained(right[t], [a, b])

QUESTION 7

(i): T

(ii) T

(iii): T

(iv): F

(v): F

(vi): 6, 7, 8

(vii): smallest C, middle B, largest A,

(viii): $1 + \frac{1}{2} + \cdots + \frac{1}{n}$

(ix): $\frac{n+1}{2}$

(x): $\frac{2n+1}{3}$

(xi): $2 \times 4^r - 1$