COMP 5511 / Fall 2020 Section DD BIPIN C DESAI
Assignment 4
Group 9
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Part 1:

Question 1:

a. What is the maximum depth of a 2,3-Tree that has 15 values?
Maximum depth of a 2,3-Tree with 15 values is 3.

b. What is the minimum depth of a 2,3-Tree that has 15 values?
Minimum depth of a 2,3-Tree with 15 values is 2.

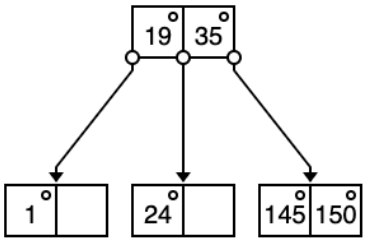
c. What is the maximum depth of a BST that has 15 values?
An unbalanced BST with 15 values can have a maximum depth of 14.

d. What is the minimum depth of a BST that has 15 values
The minimum depth of a BST with 15 values will be when the tree is perfectly balanced. In this case, the minimum depth is 3.

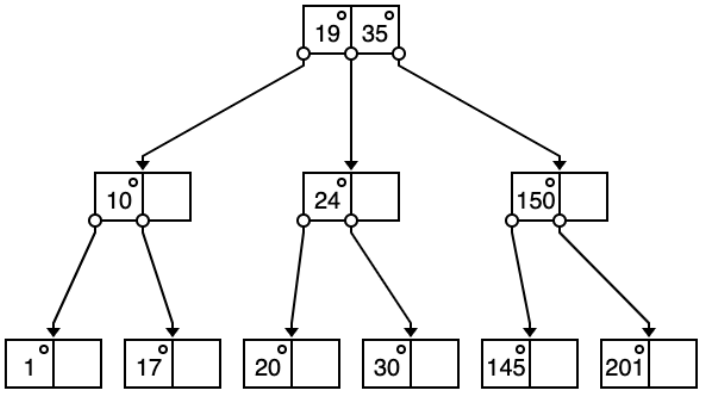
Question 2:

Draw the 2,3-Tree that you would get by starting with an empty tree and inserting the following values, in order:

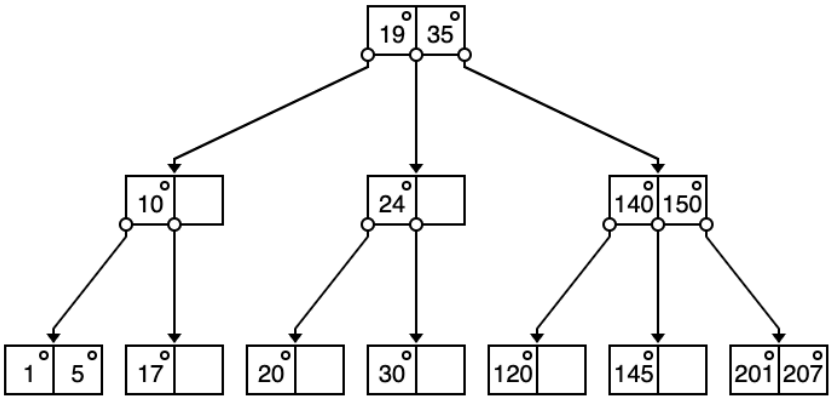
1, 150, 35, 145, 19, 24*



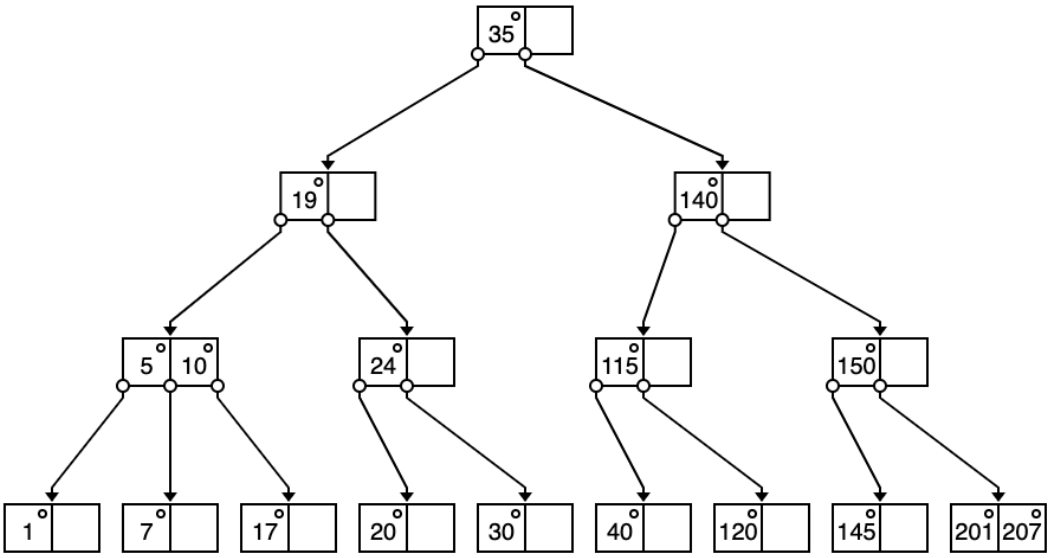
10, 17, 20, 30, 201 *



140, 207, 120, 5*



115, 40, 7*



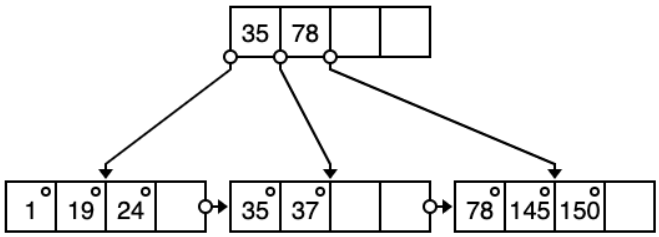
Question 3:

Draw the B+ Tree of Order 4 that you would get by starting with an empty tree and inserting the following values in order:

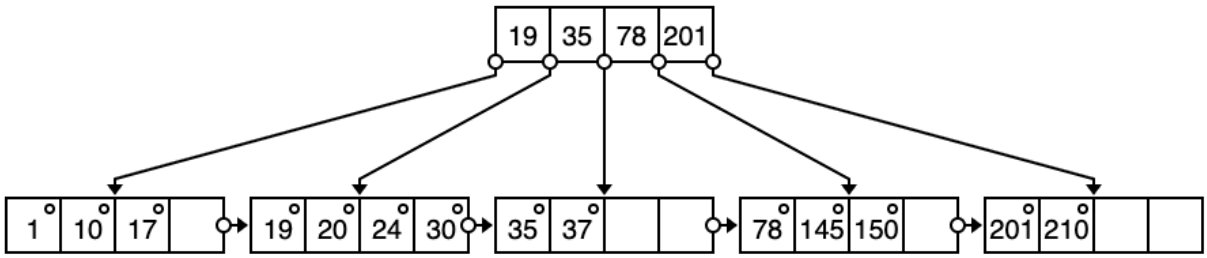
As it was not specified whether our tree should be right-leaning or left-leaning, we have created trees for both:

Left-Leaning Tree:
This is left-lean B+Tree, splitting the overflow node (5 keys) into '3 keys for the left node', '2 keys for the right node'.

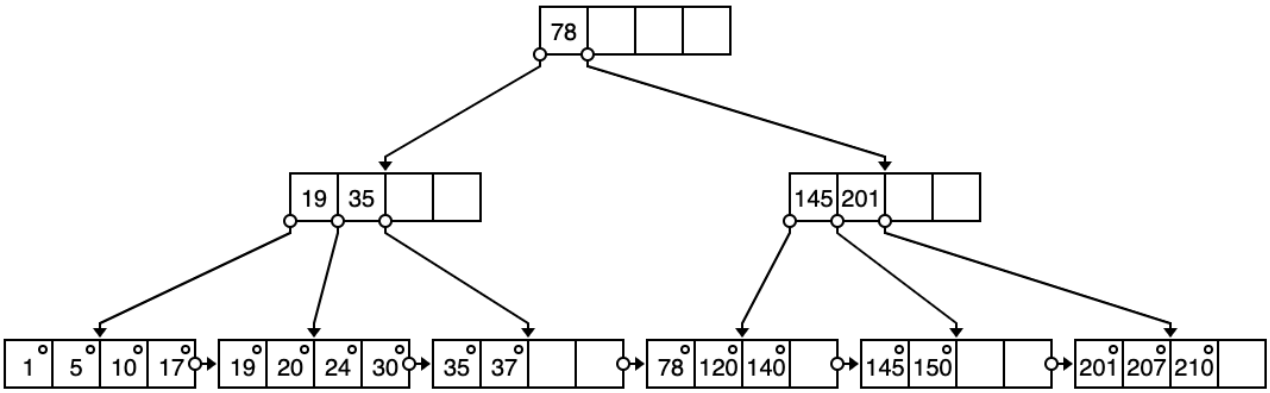
1, 78, 37, 150, 5, 145, 19 , 24*



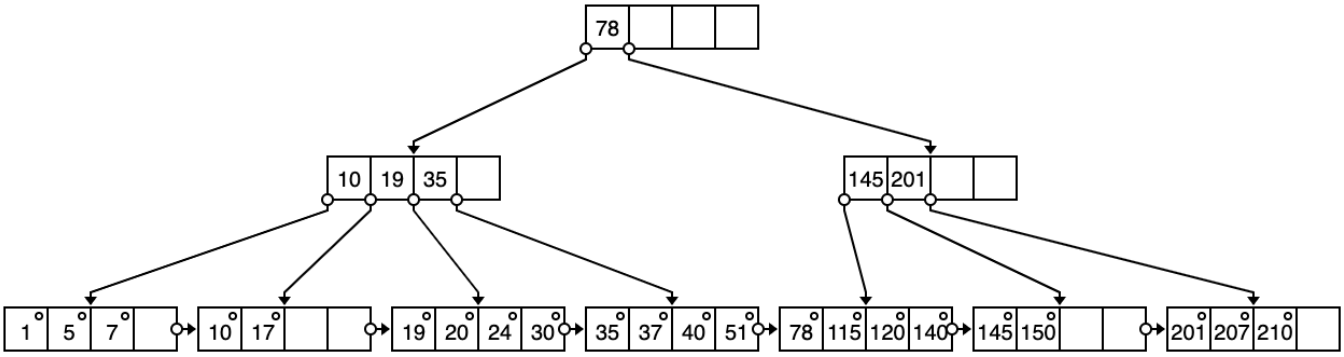
10, 210, 17, 20, 30, 201*



140, 207, 120, 5*

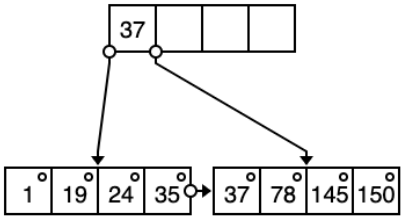


115, 51, 40, 7*

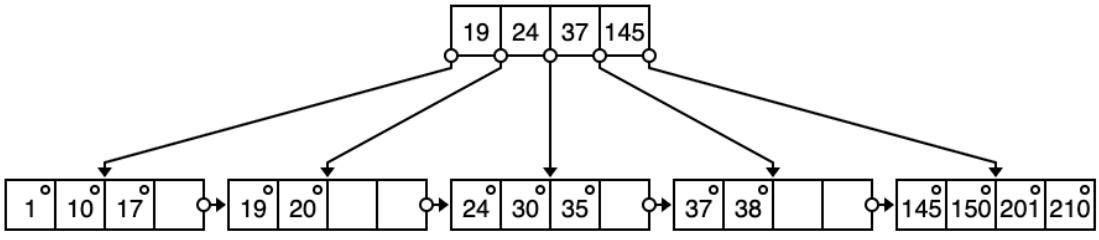


Right-Leaning Tree
This is right-lean B+Tree, splitting the overflow node (5 keys) into '2 keys for the left node', '3 keys for the right node'

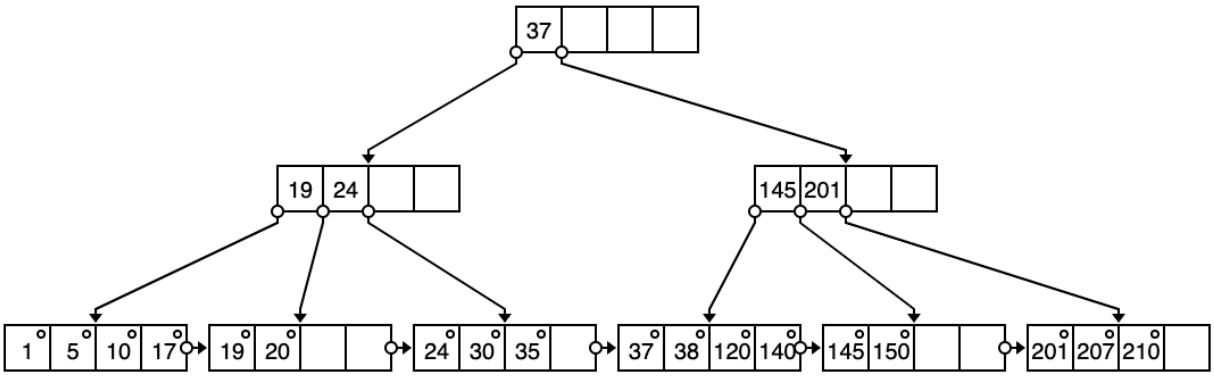
1, 78, 37, 150, 5, 145, 19 , 24*



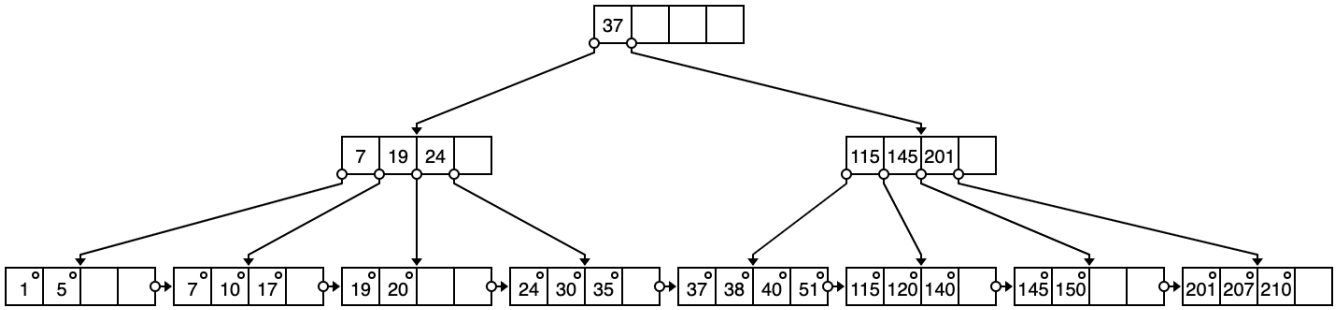
10, 210, 17, 20, 30, 201*



140, 207, 120, 5*



115, 51, 40, 7*



Question 4:

Compute the last-occurrence function and f(j) for the following patterns:

a. supercalifragilisticexpialidocious

Last Occurrence Function:

For *char* belongs to {b, h, j, k, m, n, q, v, w, y, z}: L(*char*) = -1

Char	a	c	d	e	f	g	i	l	o	p	r	s	t	u	x
L(char)	24	29	27	20	9	12	30	25	31	22	10	33	17	32	21

Failure Function:

f(j): f(16) = f(33) = 1; f(j) = 0 for $0 \leq j \leq 33$ and $j \neq 16$, $j \neq 33$

j	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33
P	s	u	p	e	r	c	a	l	i	f	r	a	g	i	l	i	s	t	i	c	e	x	p	i	a	l	i	d	o	c	i	o	u	s
f(j)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1

b. abracadabra

Last Occurrence Function:

c	a	b	c	d	r
L (c)	10	8	4	6	9

Failure Function:

j	0	1	2	3	4	5	6	7	8	9	10
P	a	b	r	a	c	a	d	a	b	r	a
f(j)	0	0	0	1	0	1	0	1	2	3	4

Question 5:

Breadth First Search Traversal:

Order of Airports (First to Last):
YUL
YQB
YQY
YYZ
YYT
YWG
YEG
YXY
YHZ
YYC
YQR
YZF
YVR

Order of Explored Flightpaths:
(Bold Flightpaths are also Cross)
YUL → YQB 270
YUL → YQY 1220
YUL → YYZ 580
YQB → YYT 1610
YQB → YWG 2202
YQB → YEG 3510
YQB → YXY 4990
YQY → YYT 660
YQY → YHZ 351
YYZ → YHZ 1410
YYZ → YYC 3090
YWG → YQR 612
YEG → YQR 793
YEG → YYC 280
YXY → YZF 1270
YYC → YVR 790
YZF → YVR 1810

Order of Cross Flightpaths:
YQY → YYT 660
YYZ → YHZ 1410
YEG → YQR 793
YEG → YYC 280
YZF → YVR 1810

Order of Discovery Edges:
YUL → YQB 270
YUL → YQY 1220
YUL → YYZ 580
YQB → YYT 1610
YQB → YWG 2202
YQB → YEG 3510
YQB → YXY 4990
YQY → YHZ 351
YYZ → YYC 3090
YWG → YQR 612
YXY → YZF 1270
YYC → YVR 790

Depth First Search Traversal:

Order of Airports (First to Last):
YUL
YQB
YYT
YQY
YHZ
YYZ
YYC
YEG
YQR
YWG
YVR
YZF
YXY

Order of Explored Flightpaths:
(Bold Flightpaths are also Back Edge:
YUL → YQB 270
YQB→ YYT 1610
YYT→ YQY 660
YQY→ YHZ 351
YHZ→ YYZ 1410
YYZ → YUL 580
YYZ → YYC 3090
YYC → YEG 280
YEG → QB 3510
YEG → YQR 793
YQR → YWG 612
YWG → YQB 2202
YYC → YVR 790
YVR → YZF 1810
YZF → YXY 1270
YXY → YQB 4990
YQY → YUL 1220

Order of Back Edge Flight Paths:
YYZ → YUL 580
YEG → QB 3510
YWG → YQB 2202
YXY → YQB 4990
YQY → YUL 1220

Order of Discovery Edges:
YUL → YQB 270
YQB→ YYT 1610
YYT→ YQY 660
YQY→ YHZ 351
YHZ→ YYZ 1410
YYZ → YYC 3090
YYC → YEG 280
YEG → YQR 793
YQR → YWG 612
YYC → YVR 790
YVR → YZF 1810
YZF → YXY 1270