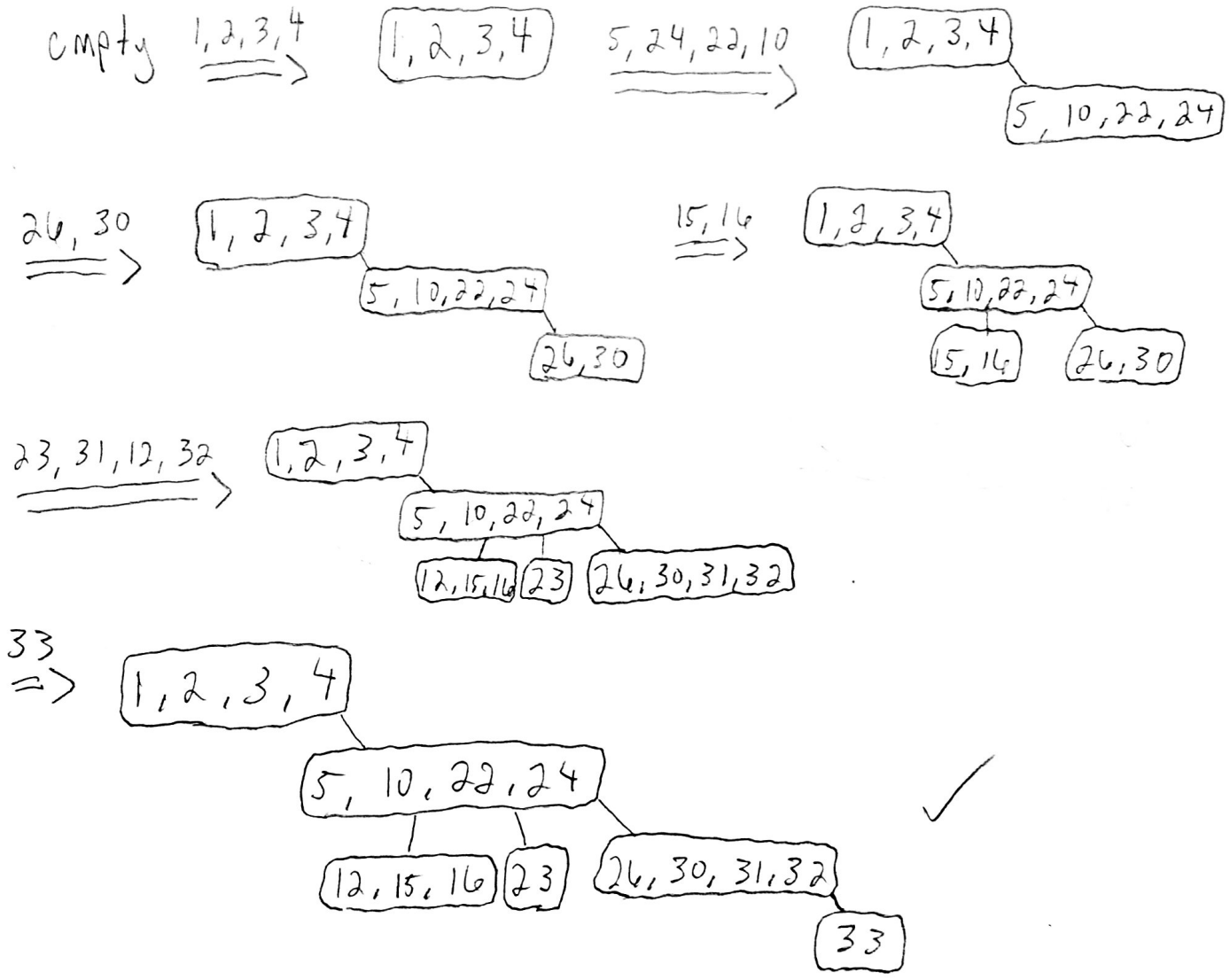
Assignment 4

Kevin
Wilson
syx009

1. Understanding Multiway Search Trees

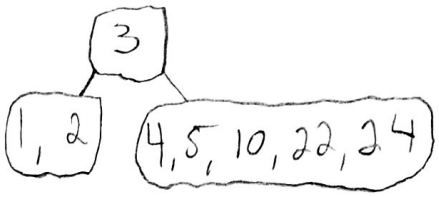
#'s - 1, 2, 3, 4, 5, 24, 22, 10, 26, 30, 15, 16, 23, 31, 12, 32, 33

(1) Top-down tree of order 5

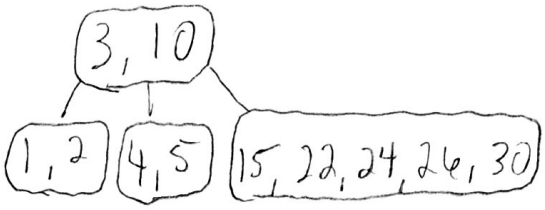


(2) B tree of order 5 At least $(5-1)/2 = 2$ keys, except root

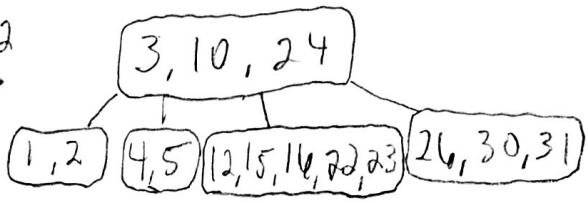
empty → 1,2,3,4,5 → [1,2,3,4,5] → 24,22,10 →



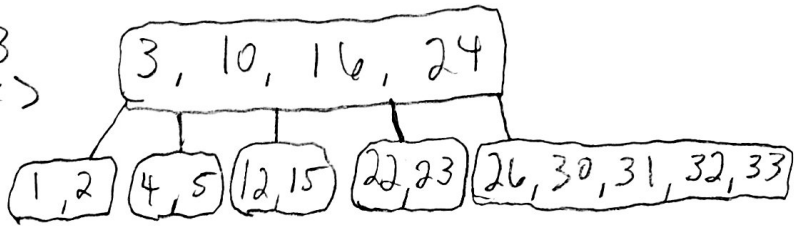
26, 30, 15 →



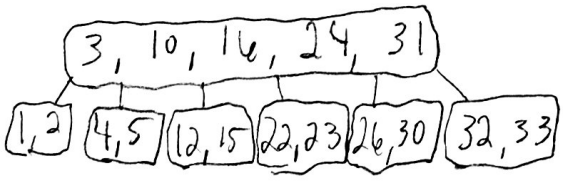
16, 23, 31, 12 →



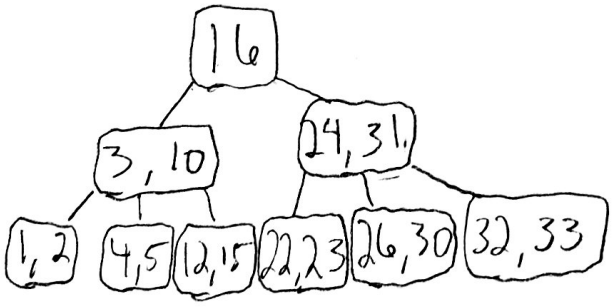
32, 33 →



⇒

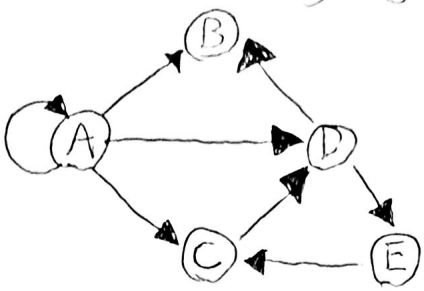


⇒



✓

2. Understanding graphs



(1) Find adjacency matrix representation.

	A	B	C	D	E
A	1	1	1	1	0
B	0	0	0	0	0
C	0	0	0	1	0
D	0	1	0	0	1
E	0	0	1	0	0

(2) Find path matrix using powers of adjacency matrix. Need $n=5$ powers to find. Then OR all 5 powers

K_1

	A	B	C	D	E
A	1	1	1	1	0
B	0	0	0	0	0
C	0	0	0	1	0
D	0	1	0	0	1
E	0	0	1	0	0

AND
X

K_1

	A	B	C	D	E
A	1	1	1	1	0
B	0	0	0	0	0
C	0	0	0	1	0
D	0	1	0	0	1
E	0	0	1	0	0

=

K_2

	A	B	C	D	E
A	1	1	1	1	1
B	0	0	0	0	0
C	0	1	0	0	1
D	0	0	1	0	0
E	0	0	0	1	0

K_2

	A	B	C	D	E
A	1	1	1	1	1
B	0	0	0	0	0
C	0	1	0	0	1
D	0	0	1	0	0
E	0	0	0	1	0

AND
X

K_1

	A	B	C	D	E
A	1	1	1	1	0
B	0	0	0	0	0
C	0	0	0	1	0
D	0	1	0	0	1
E	0	0	1	0	0

=

K_3

	A	B	C	D	E
A	1	1	1	1	1
B	0	0	0	0	0
C	0	0	1	0	0
D	0	0	0	1	0
E	0	1	0	0	1

k_3

	A	B	C	D	E
A	1	1	1	1	1
B	0	0	0	0	0
C	0	0	1	0	0
D	0	0	0	1	0
E	0	1	0	0	1

AND
×

k_1

	A	B	C	D	E
A	1	1	1	1	0
B	0	0	0	0	0
C	0	0	0	1	0
D	0	1	0	0	1
E	0	0	1	0	0

=

k_4

	A	B	C	D	E
A	1	1	1	1	1
B	0	0	0	0	0
C	0	0	0	1	0
D	0	1	0	0	1
E	0	0	1	0	0

k_4

	A	B	C	D	E
A	1	1	1	1	1
B	0	0	0	0	0
C	0	0	0	1	0
D	0	1	0	0	1
E	0	0	1	0	0

AND
×

k_1

	A	B	C	D	E
A	1	1	1	1	0
B	0	0	0	0	0
C	0	0	0	1	0
D	0	1	0	0	1
E	0	0	1	0	0

=

k_5

	A	B	C	D	E
A	1	1	1	1	1
B	0	0	0	0	0
C	0	1	0	0	1
D	0	0	1	0	0
E	0	0	0	1	0

k_1 OR k_2 OR k_3 OR k_4 OR k_5 =

Path Matrix

	A	B	C	D	E
A	1	1	1	1	1
B	0	0	0	0	0
C	0	1	1	1	1
D	0	1	1	1	1
E	0	1	1	1	1

✓

(3) Find path matrix using Warshall's algorithm. Find $n = 5$ relations, where R_5 is path Matrix.

R_0

	A	B	C	D	E
A	1	1	1	1	0
B	0	0	0	0	0
C	0	0	0	1	0
D	0	1	0	0	1
E	0	0	1	0	0

Paths that go through A

$=$

R_1

	A	B	C	D	E
A	1	1	1	1	0
B	0	0	0	0	0
C	0	0	0	1	0
D	0	1	0	0	1
E	0	0	1	0	0

R_1

	A	B	C	D	E
A	1	1	1	1	0
B	0	0	0	0	0
C	0	0	0	1	0
D	0	1	0	0	1
E	0	0	1	0	0

Paths that go through B

$=$

R_2

	A	B	C	D	E
A	1	1	1	1	0
B	0	0	0	0	0
C	0	0	0	1	0
D	0	1	0	0	1
E	0	0	1	0	0

R_2

	A	B	C	D	E
A	1	1	1	1	0
B	0	0	0	0	0
C	0	0	0	1	0
D	0	1	0	0	1
E	0	0	1	0	0

Paths that go through C

$=$

R_3

	A	B	C	D	E
A	1	1	1	1	0
B	0	0	0	0	0
C	0	0	0	1	0
D	0	1	0	0	1
E	0	0	1	1	0

R_3

	A	B	C	D	E
A	1	1	1	1	0
B	0	0	0	0	0
C	0	0	0	1	0
D	0	1	0	0	1
E	0	0	1	1	0

Paths that go through D

=

R_4

	A	B	C	D	E
A	1	1	1	1	1
B	0	0	0	0	0
C	0	1	0	1	1
D	0	1	0	0	1
E	0	1	1	1	1

R_4

	A	B	C	D	E
A	1	1	1	1	1
B	0	0	0	0	0
C	0	1	0	1	1
D	0	1	0	0	1
E	0	1	1	1	1

Paths that go through E

=

R_5 = Path Matrix

	A	B	C	D	E
A	1	1	1	1	1
B	0	0	0	0	0
C	0	1	1	1	1
D	0	1	1	1	1
E	0	1	1	1	1