CSC 212 Tutorial #11 Solution
B+ Trees
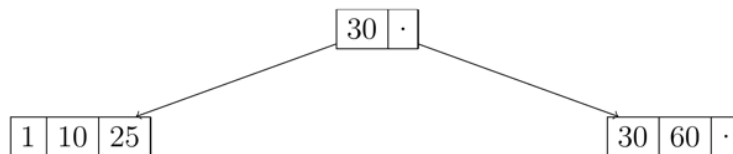
Problem 1

$$\boxed{10 \mid 30 \mid 60}$$

Inserting (30, 10, 60)

```
                    30 | ·
              /              \
      10 | 25 | ·          30 | 60 | ·
```
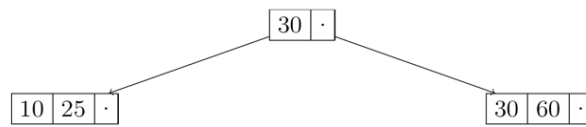
Inserting (25): split root as leaf; new root

```
                    30 | ·
              /              \
      1 | 10 | 25          30 | 60 | ·
```

Inserting (1)

```
                    25 | ·
              /              \
      1 | 10 | 20          25 | 30 | 60
```
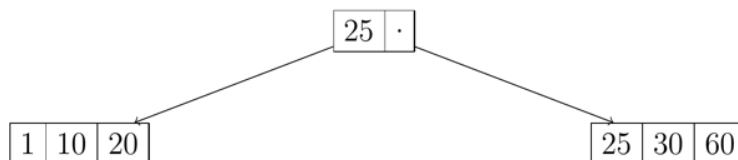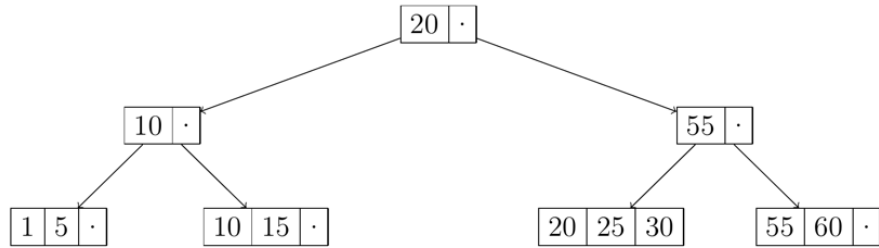
Inserting (20): transfer datum to next sibling
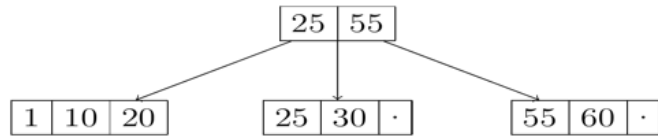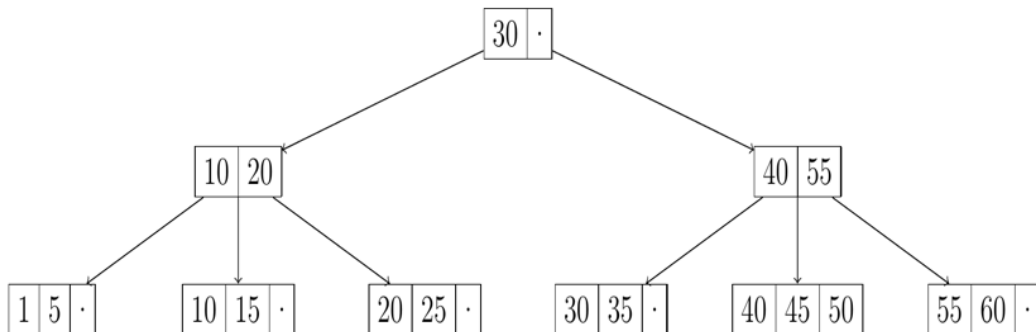
Inserting (55): split leaf

Problem 2

Inserting (15): split leaf; split parent; new root

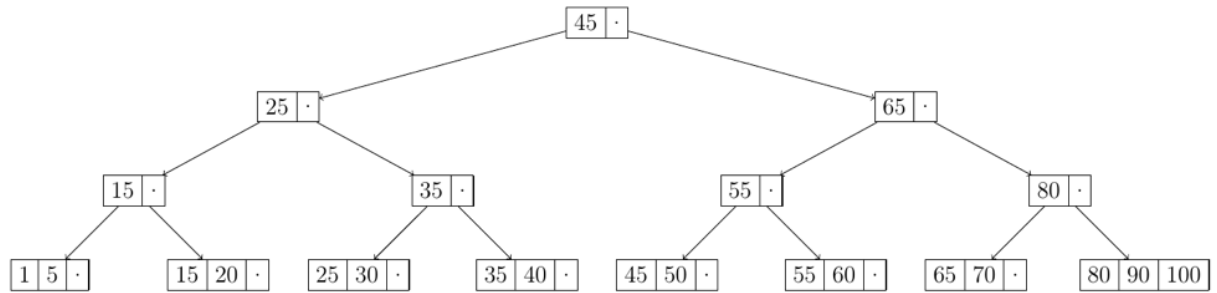1.

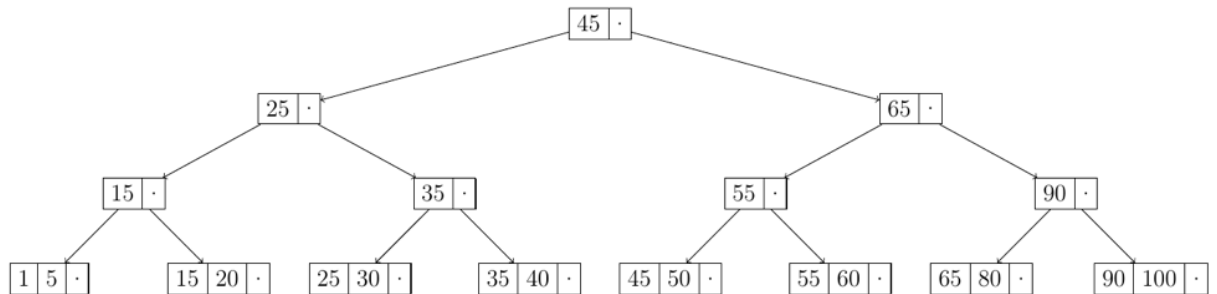

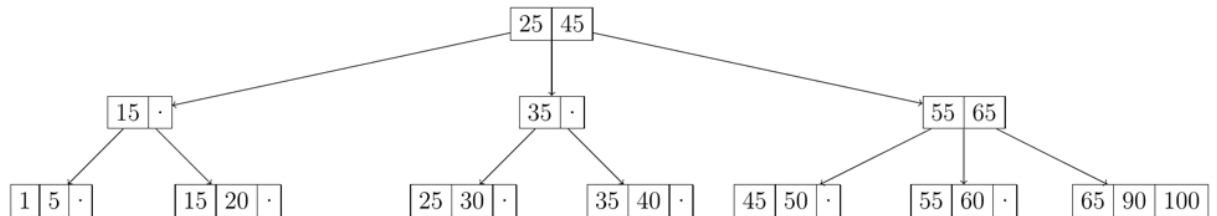Inserting (35); split leaf; transfer leaf to next sibling

2.

Problem 3

Tree 1:
- 45 ·
  - 25 ·
    - 15 ·
      - 1 5 ·
      - 15 20 ·
    - 35 ·
      - 25 30 ·
      - 35 40 ·
  - 65 ·
    - 55 ·
      - 45 50 ·
      - 55 60 ·
    - 80 ·
      - 65 70 ·
      - 80 90 100

Deleting (75)

Tree 2:
- 45 ·
  - 25 ·
    - 15 ·
      - 1 5 ·
      - 15 20 ·
    - 35 ·
      - 25 30 ·
      - 35 40 ·
  - 65 ·
    - 55 ·
      - 45 50 ·
      - 55 60 ·
    - 90 ·
      - 65 80 ·
      - 90 100 ·

Deleting (70): borrow datum from next sibling

Tree 3:
- 25 45
  - 15 ·
    - 1 5 ·
    - 15 20 ·
  - 35 ·
    - 25 30 ·
    - 35 40 ·
  - 55 65
    - 45 50 ·
    - 55 60 ·
    - 65 90 100

Deleting (80): merge leaf with next sibling; merge parent with sibling; merge parent with sibling; delete root

Tree 4:
- 25 55
  - 15 ·
    - 1 5 ·
    - 15 20 ·
  - 45 ·
    - 25 35 40
    - 45 50 ·
  - 65 ·
    - 55 60 ·
    - 65 90 100
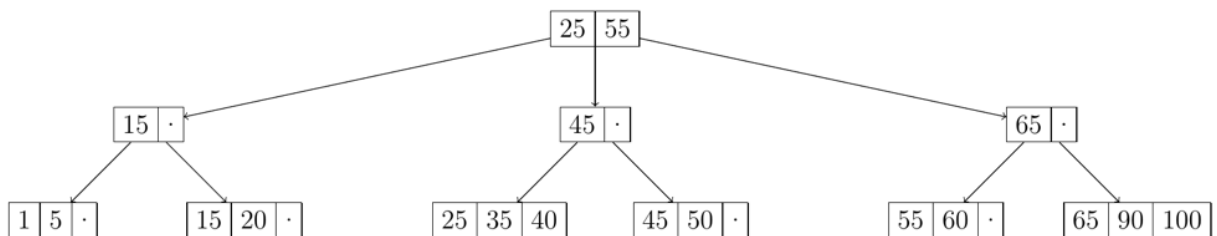
Deleting (30): merge leaf with next sibling; borrow leaf from next sibling