Discrete Optimization

Assignments: Set Cover
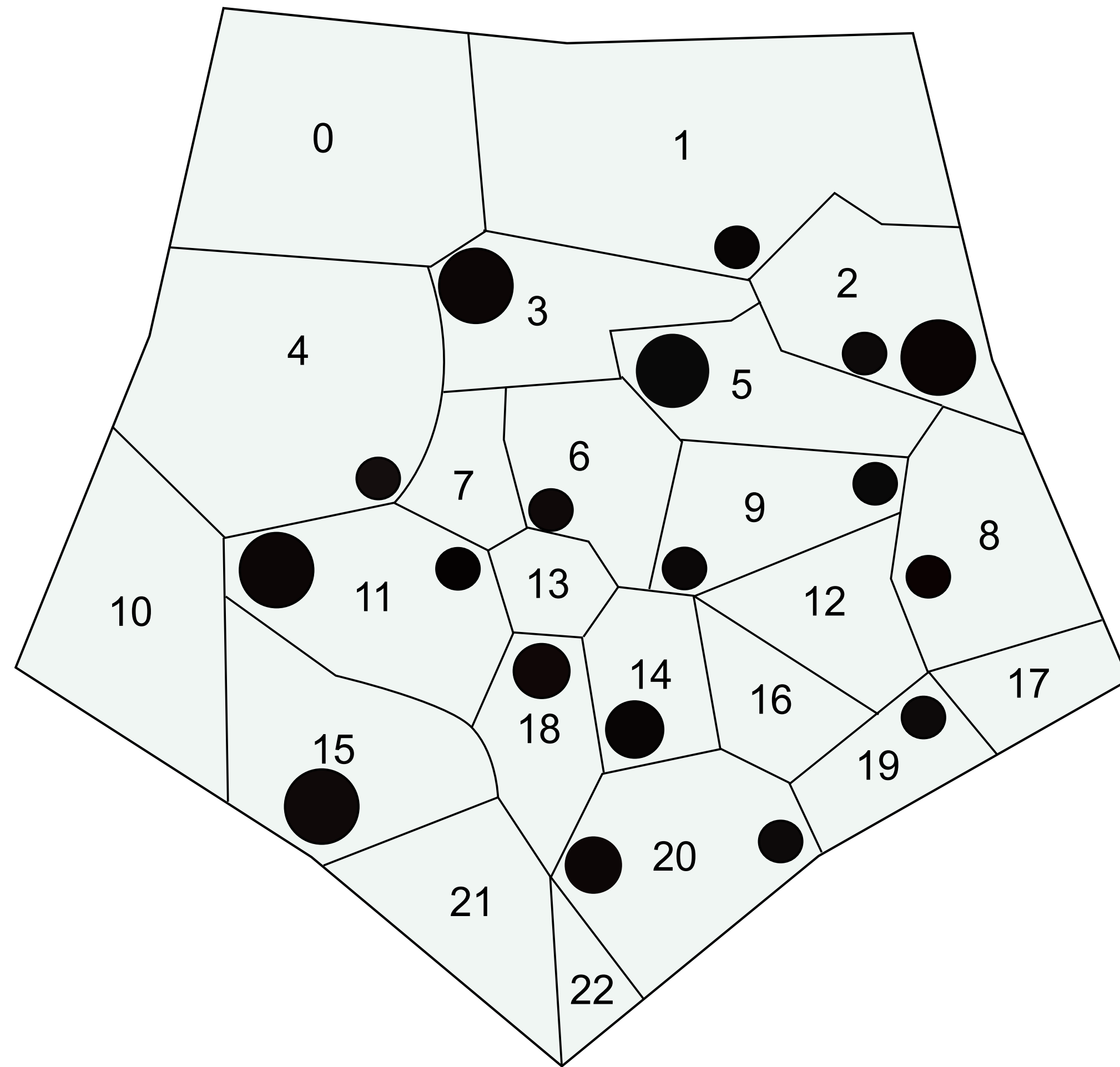
22 regions and 18 possible firestations
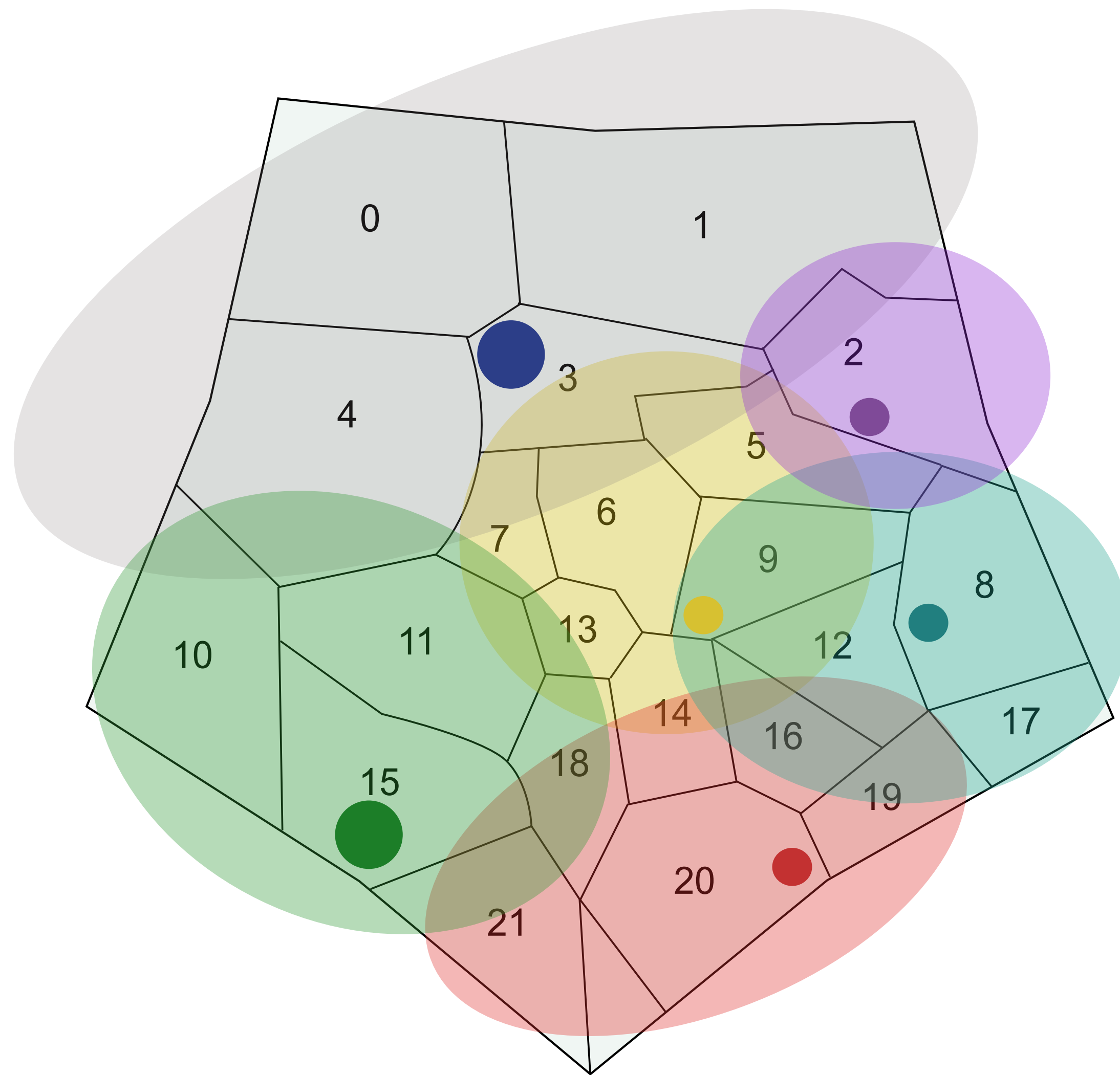
6 selected firestations and their coverage

Set Cover

- *n* Items (regions),
- *m* Sets (fire stations),
- Set costs c_i
- *Covered items S_i*
- *x_i = 1 if set i is selected*

$$\text{minimize:} \quad \sum_{i \in M} c_i x_i$$

$$\text{subject to:}$$

$$\sum_{i \in M} (j \in S_i) x_i \geq 1 \quad (j \in N)$$

$$x_i \in \{0, 1\}$$

$$\text{minimize:} \quad \sum_{i \in M} c_i x_i$$

$$\text{subject to:}$$

$$\sum_{i \in M} (j \in S_i) x_i \geq 1 \quad (j \in N)$$

$$x_i \in \{0, 1\}$$

Input

```
|N| |M|
c_0 s_0_0 s_0_1 ...
c_1 s_1_0 s_1_1 ...
c_2 s_2_0 s_2_1 ...
...
c_|M|-1 s_(|M|-1)_0  ...
```

Output

```
obj opt
x_0 x_1 ... x_|M|-1
```

minimize:
$$\sum_{i \in M} c_i x_i$$

subject to:

$$\sum_{i \in M} (j \in S_i) x_i \geq 1 \quad (j \in N)$$

$$x_i \in \{0, 1\}$$

Input

```
5 4
12.0 0 2
7.0 1 2 3
10.0 1 4
5.0 4
```
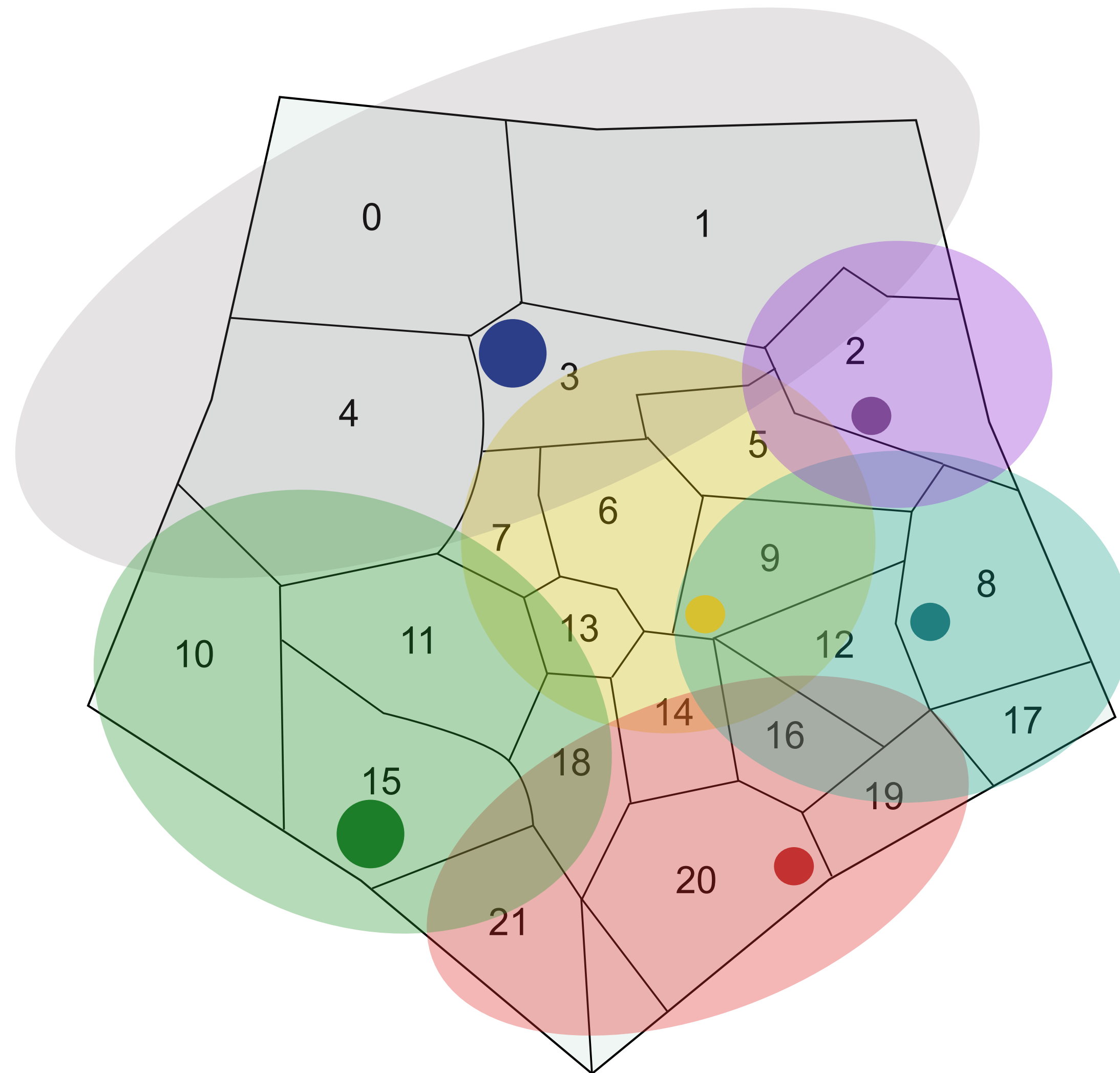
Output

```
24.0 0
1 1 0 1
```

Open Source

▸ We provide some examples
  – simple greedy solvers

  – simple CP style solver

  – calling an external tool

  – …

▸ Share code with your classmates
  – github.com/discreteoptimization

▸ Share algorithms, not specific solutions
  – a lookup table is a really boring algorithm

6 selected firestations and their coverage