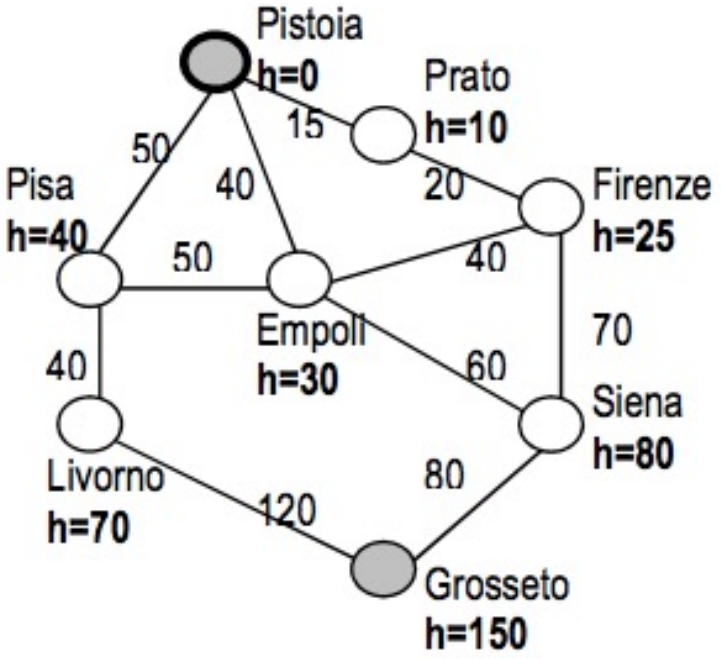
EXERCISES - 4

Ex 11

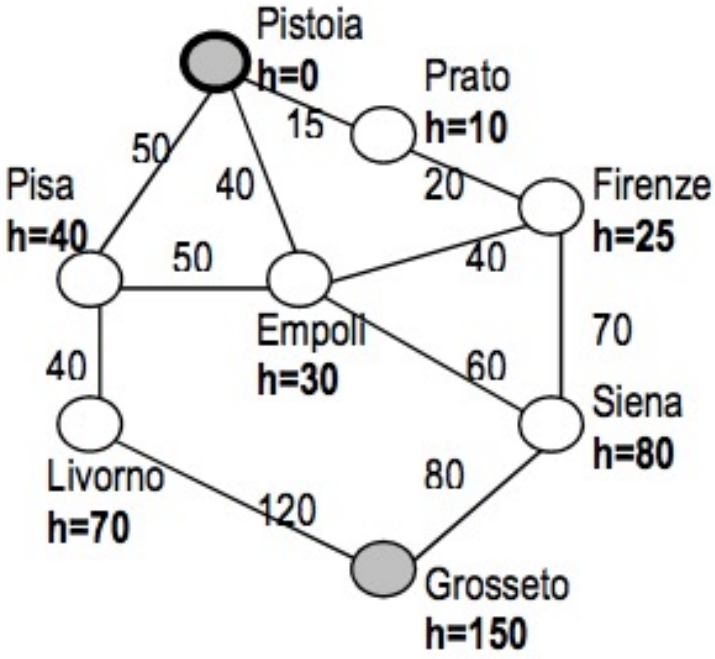
A* search

- Given the following map, use the A* algorithm to find the fastest path between Grosseto and Pistoia
- Next to each city there is the heuristic estimate of its distance from Pistoia
- Next to each road is the actual length of the road section



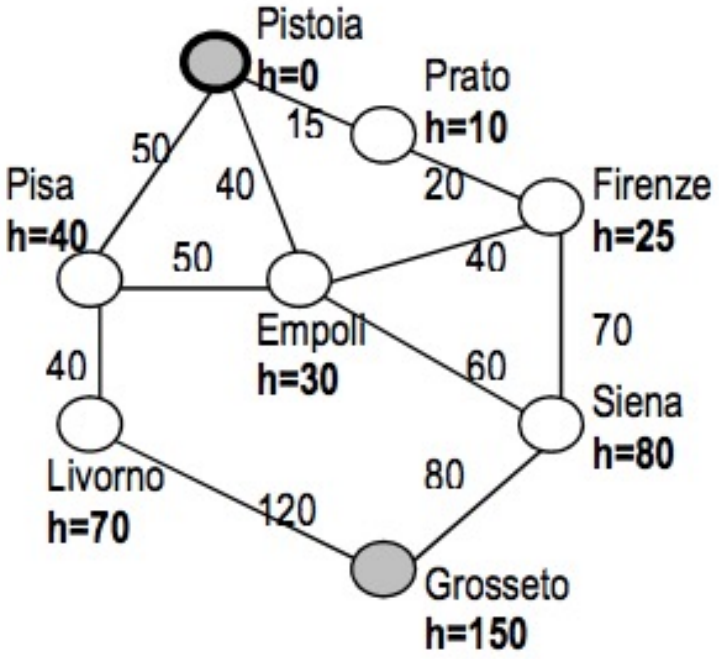
A* search

- Use A* to find the solution and show the expanded search tree, taking into account that the nodes are considered from West to East and in doubt A* always expands the leftmost node

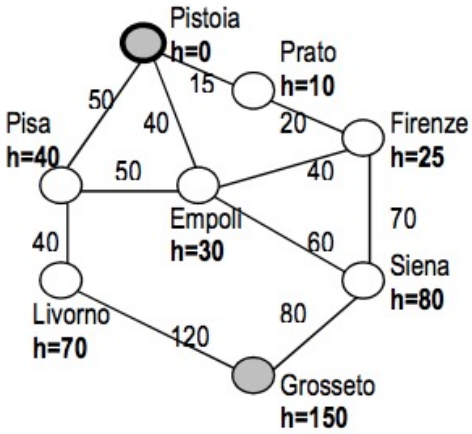


A* search

- Based on the values in the map, it should also be stated whether the heuristics is admissible. Motivate the answer.



1. Use A* to find the solution and show the expanded search tree

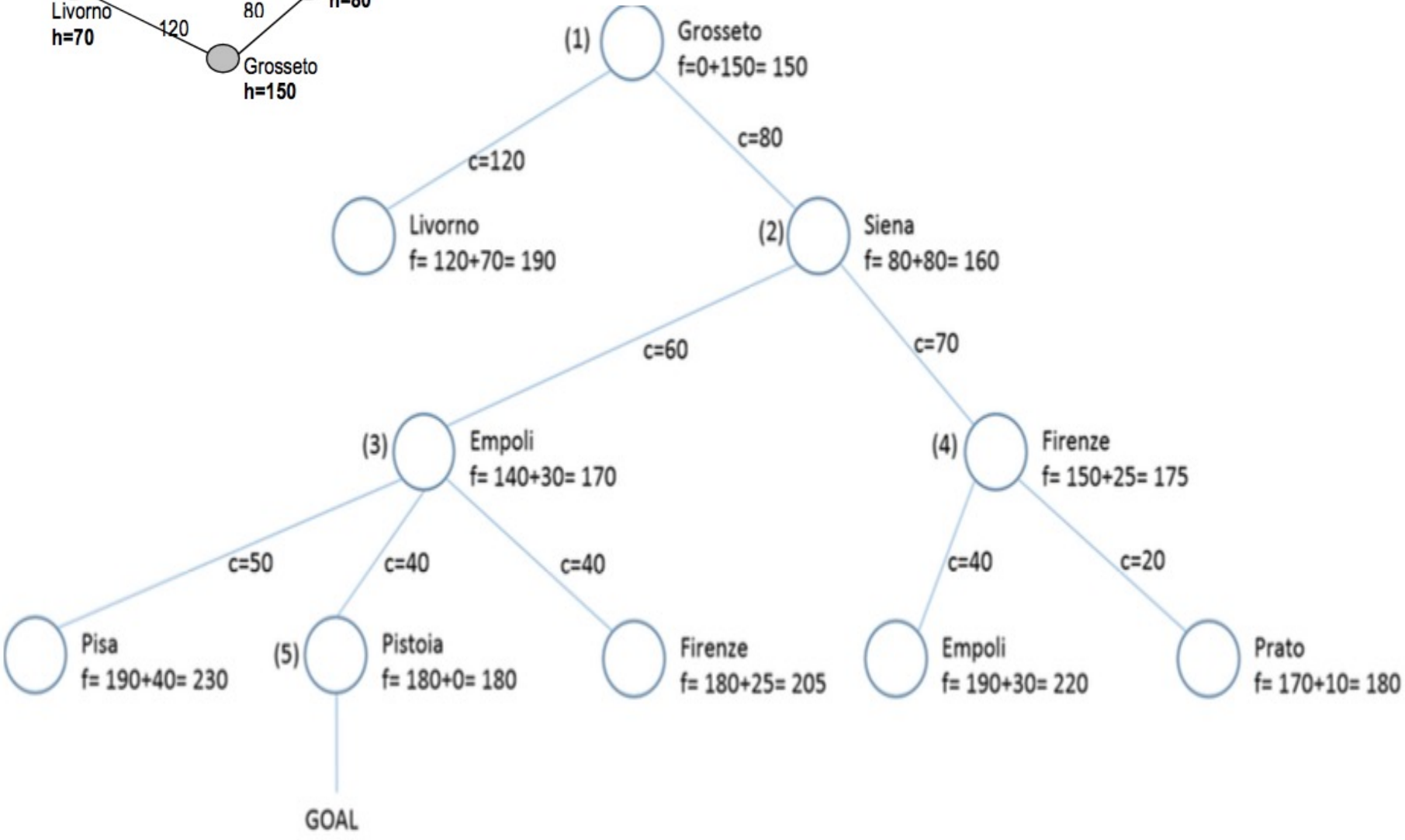


REVIEW:

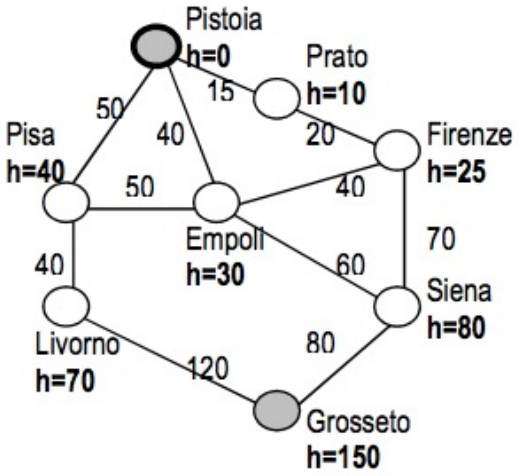
A* expands **first** the node with the **lowest value** of **f(n)**=**g(n)** + **h(n)**

g(n) = **path cost** from the **start node** to **node n**

h(n) = estimated cost of the **cheapest path** from **n** to **goal**



2. Based on the values in the map, it should also be stated whether the heuristics is admissible.



REVIEW:
A heuristic h is **admissible** if
for every node ***n***, $h(n) \leq h^*(n)$
where $h^*(n)$ is the **true cost** from ***n*** to ***goal***

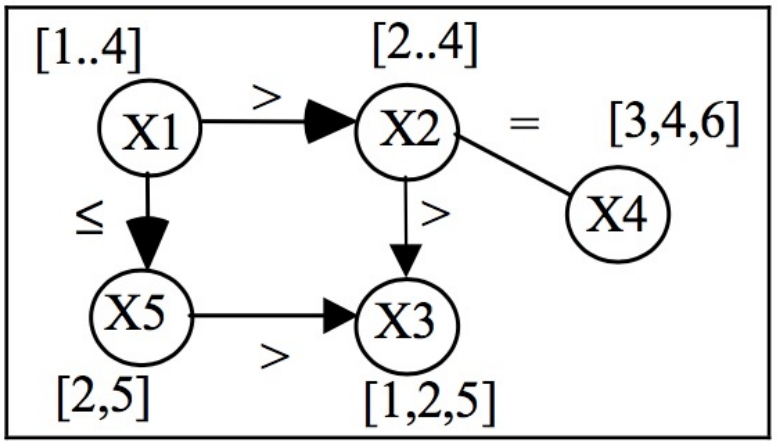
In this example the heuristics is admissible because
the heuristic estimate, for each node,
is always less or equal to the true distance from the goal

Ex 12

CSP

Consider a CSP

- with five variables X1, X2, X3, X4, X5
- with the following domains
  - $D_{X1}=\{1,2,3,4\}$
  - $D_{X2}=\{2,3,4\}$
  - $D_{X3}=\{1,2,5\}$
  - $D_{X4}=\{3,4,6\}$
  - $D_{X5}=\{2,5\}$



- with the following constraints
  - X1>X2, X2=X4, X2>X3, X1≤ X5, X5>X3

- Apply the arc-consistency to the the network

CSP- Arc Consistency

- REVIEW:
  - Assume there is a binary **constraint** between **X** and **Y**,

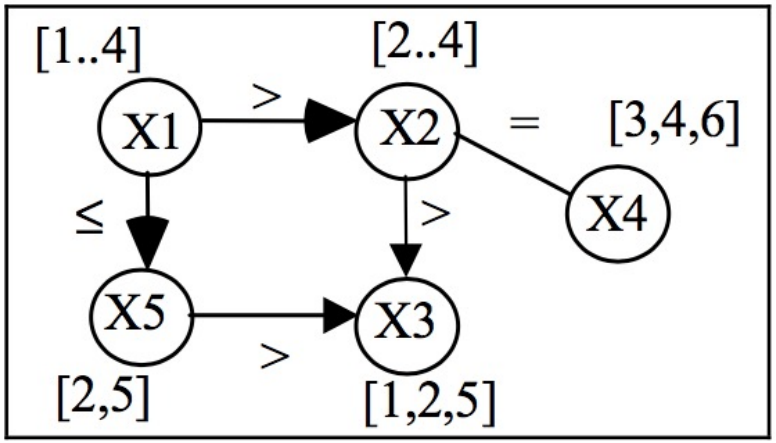
    X is **arc consistent** w.r.t. **Y** iff

    for every value ***x*** for ***X***, there is **some allowed** ***y*** *for* **Y** that **satisfies** the binary constraint between **X** and **Y**

  - We can **enforce X** to be **arc-consistency** w.r.t. **Y** by **removing** all the values x in the domain of **X** for which there is **no corresponding value y** in the domain of **Y** that **satisfies** the constraint between **X** and **Y**

CSP

D_{X1}= {1,2,3,4}
D_{X2} = {2,3,4}
D_{X3}= {1,2,5}
D_{X4} = {3,4,6}
D_{X5}= {2,5}



- The domains of the variables changed at the end of the Arc Consistency are
  - D_{X1}= {4}
  - D_{X2} = {3}
  - D_{X3}= {1,2}
  - D_{X4} = {3}
  - D_{X5}= {5}