Introduction to Artificial Intelligence

Jaderick P. Pabico
Institute of Computer Science, College of Arts and Sciences
University of the Philippines Los Baños, College 4031, Laguna

CMSC 170 – Introduction to AI
2nd Semester 2009-2010

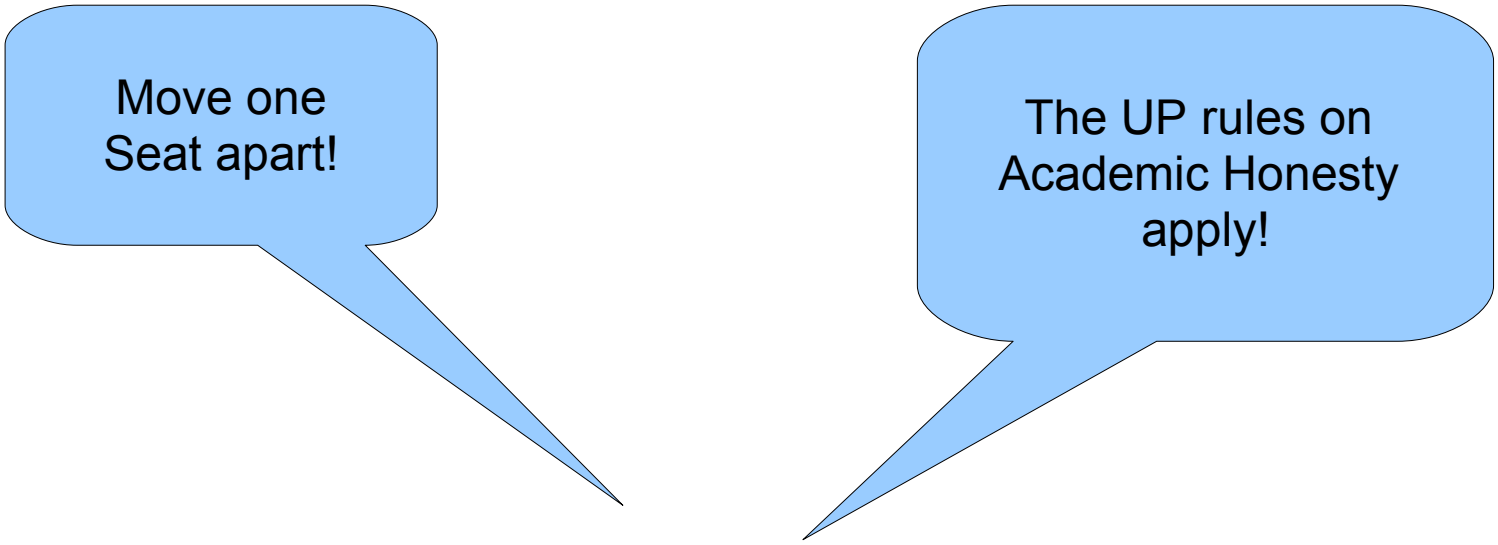
On a ¼ sheet of paper write...

Your name

Today's date (15 Dec 2009)

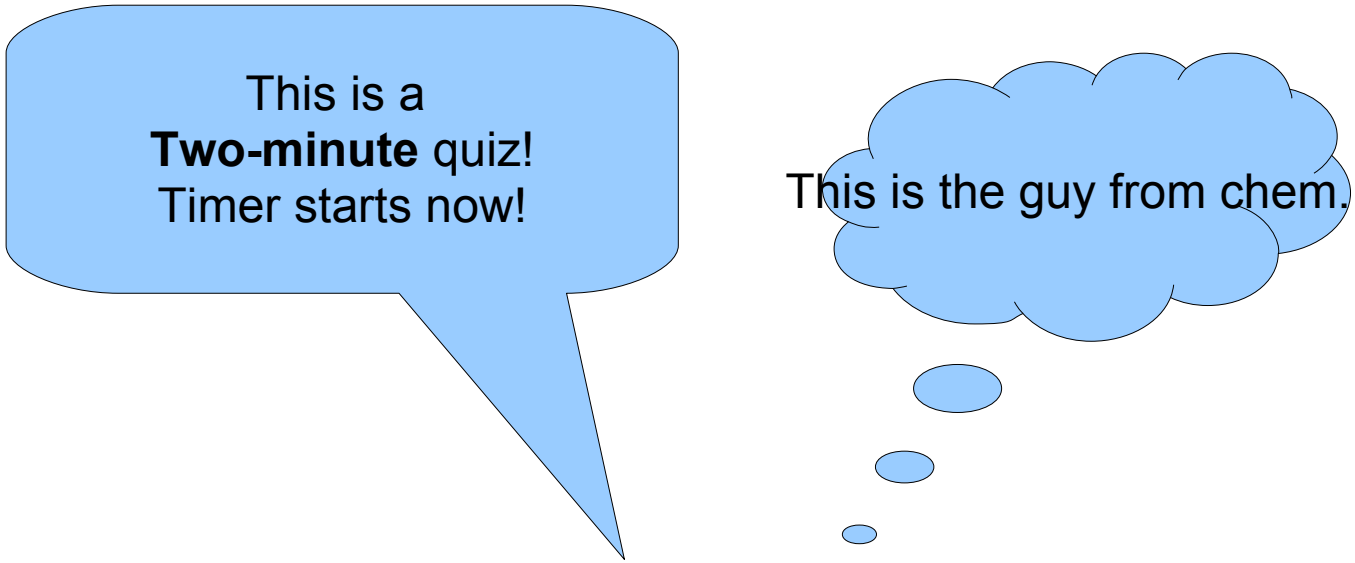
CMSC 170 + Laboratory Section

And then, answer the following questions...



Quiz question

In the 2nd CAS UPLB Student-Faculty Research Conference, who presented the topic "**Structural Analysis of the Collaboration Network of Filipino Scientists**"



Quiz question

In t dent-Faculty Research
Co the topic “Structural
Ar n Network of Filipino
Sc

TIME IS UP!

Pass papers towards the center aisle. People at The center aisle pass Forward. And two people in Front pass them to teacher!

Answer to quiz

Prof. Jose Rene L. Micor

Issue last meeting

Is the complexity of BFS $O(b^d)$ or $O(b^m)$?

It should be $O(b^m)$ because I search the Internet and it says so!

No! Internet does not give you the correct answer always

Issue last meeting

Since the quiz question was asking for the respective complexities in terms of *b*, *d*, and *m*, the correct answer in this case is $O(b^d)$.

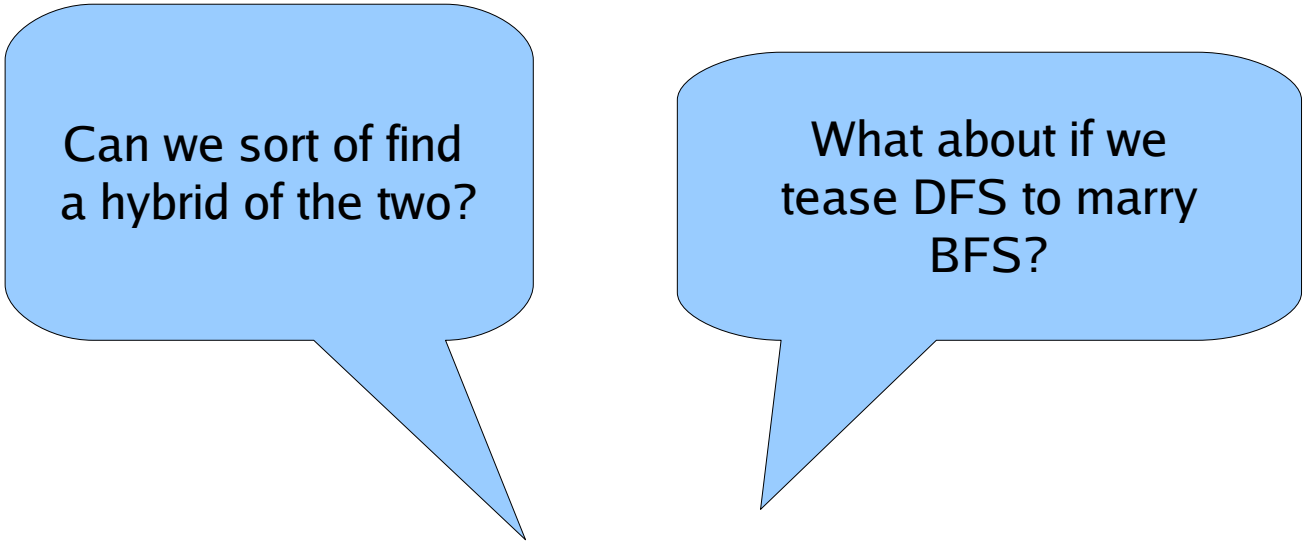
Most Internet sources only Describe the complexities In terms of *b* and *m* only.

Sometimes, we must think hard enough before we accept information from the Internet as correct.

Hybrid Technique

DFS is efficient in space (or memory) but we are not guaranteed to get the optimal path length.

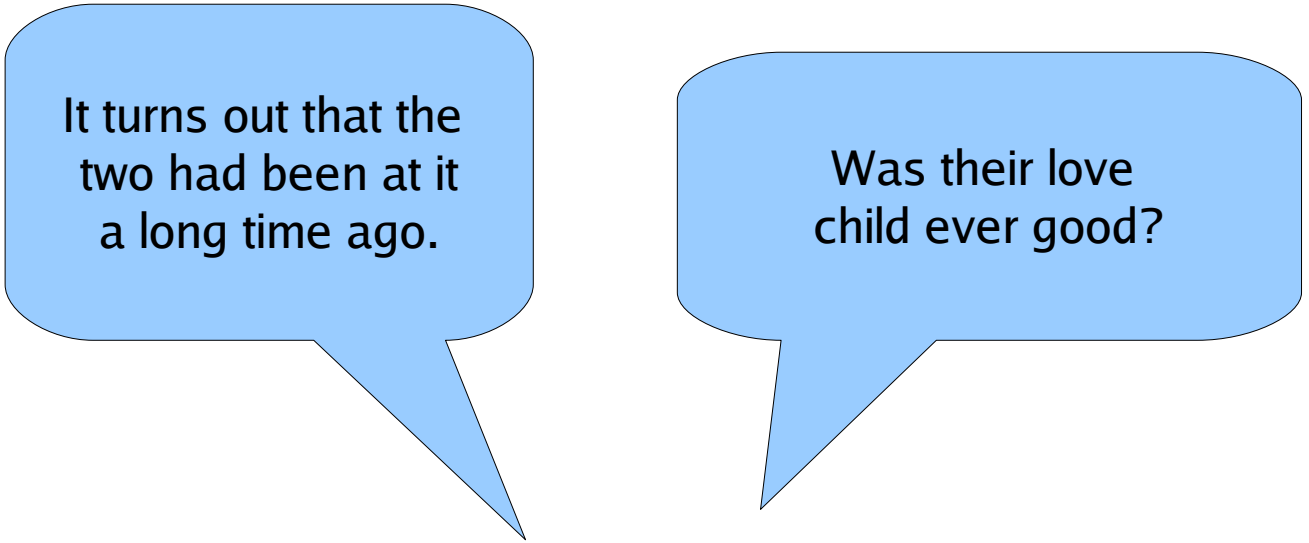
BFS guarantees it but is not efficient in using space (or memory).



Iterative Deepening

Iterative Deepening: hybrid DFS and BFS

Perform a sequence of DFS searches with increasing depth-cut until goal is found.



Iterative Deepening

Cut-off Depth	Space	Time
1	$O(b)$	$O(b)$
2	$O(2b)$	$O(b^2)$
3	$O(3b)$	$O(b^3)$
4	$O(4b)$	$O(b^4)$
…	…	…
d	$O(db)$	$O(b^d)$
Total	**Max= $O(db)$**	**Total = $O(b^{d+1})$**

Uniform Cost Search

BFS and Iterative Deepening find find with fewest steps (or time).

But what if steps have unequal cost?

Uniform Cost Search

How can we find the shortest path (measured by the sum of distances along the path)?

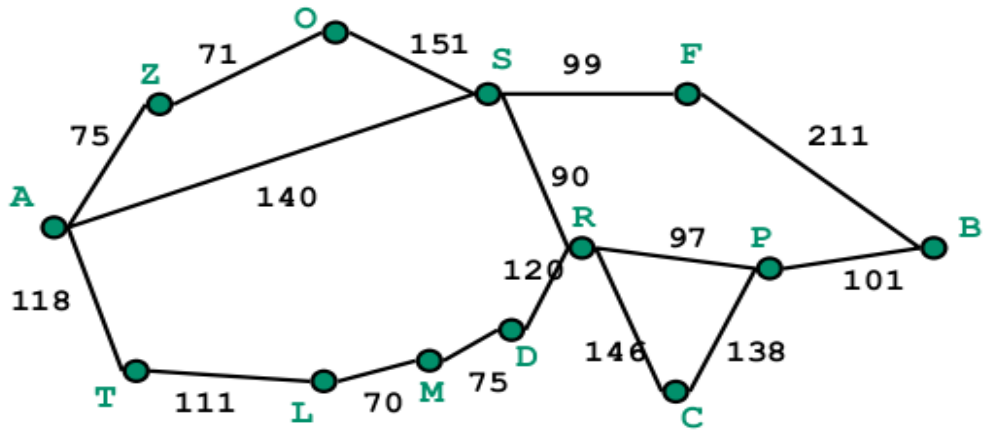
Uniform Cost Search:

- Nodes in agenda keeps track of total path length from start to that node
- Agenda is kept in priority queue ordered by path length
- Get shortest path in queue

Uniform Cost Search

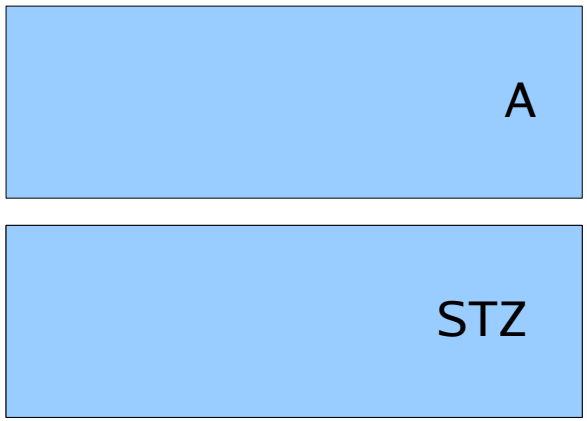
Example:

A

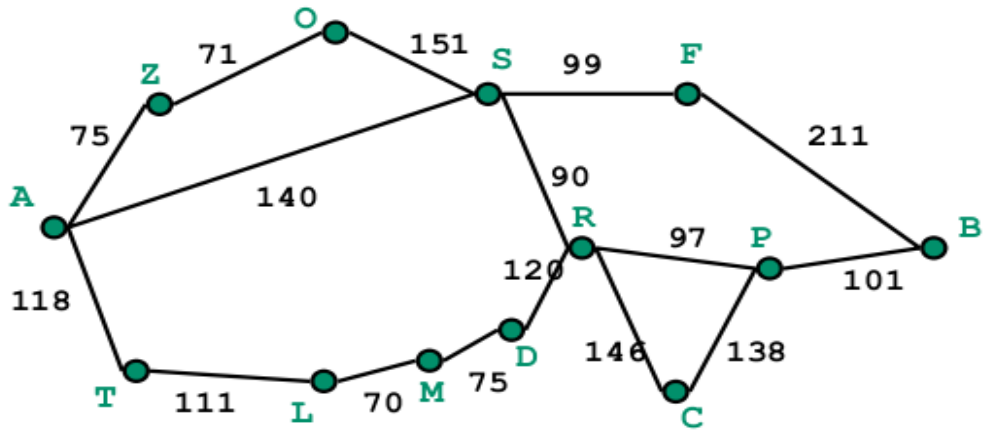


Uniform Cost Search

Example:

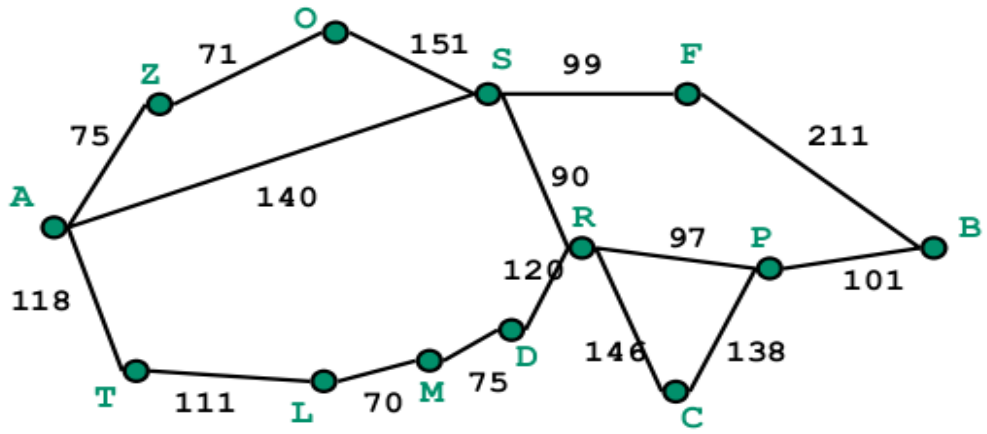


A



Uniform Cost Search

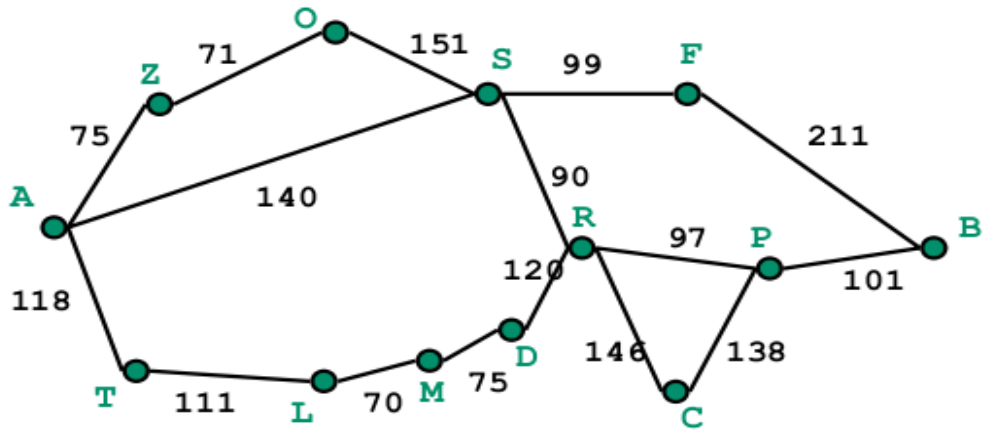
Example:



A	
STZ	A
OST	ZA

Uniform Cost Search

Example:



A	
STZ	A
OST	ZA
LOS	TZA

Uniform Cost Search

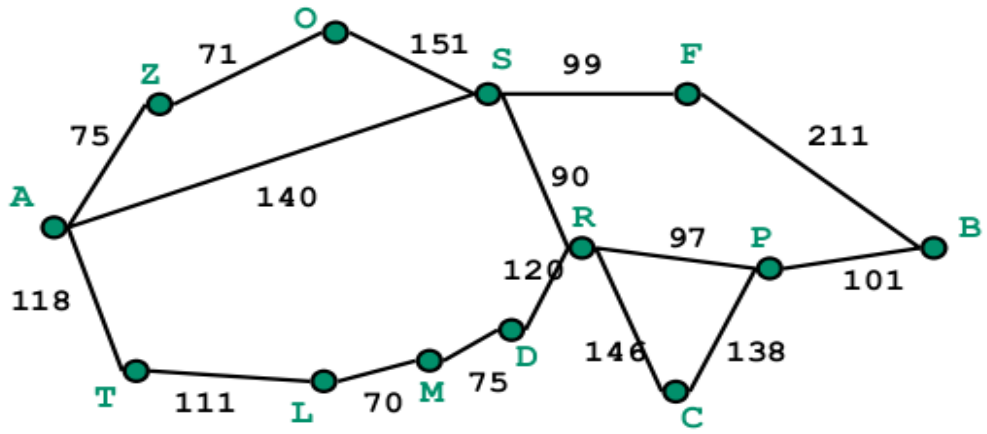
Example:

LOS

OFRLO

TZA

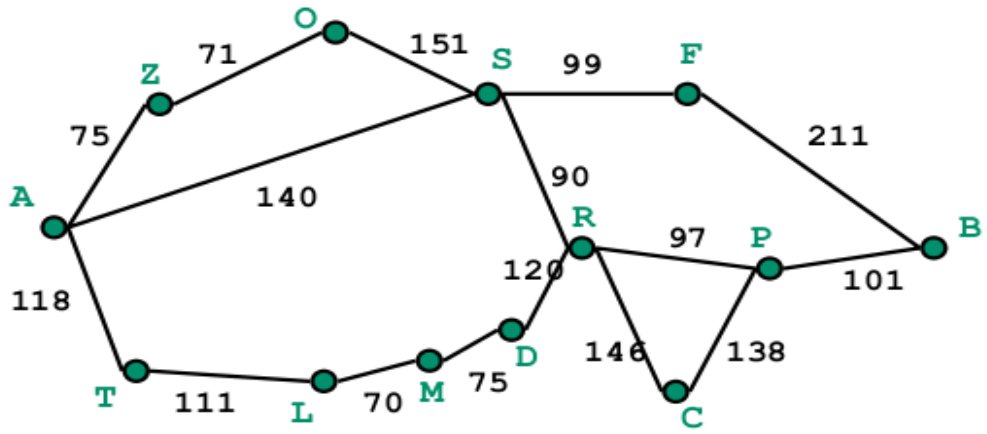
STZA



Uniform Cost Search

Example:

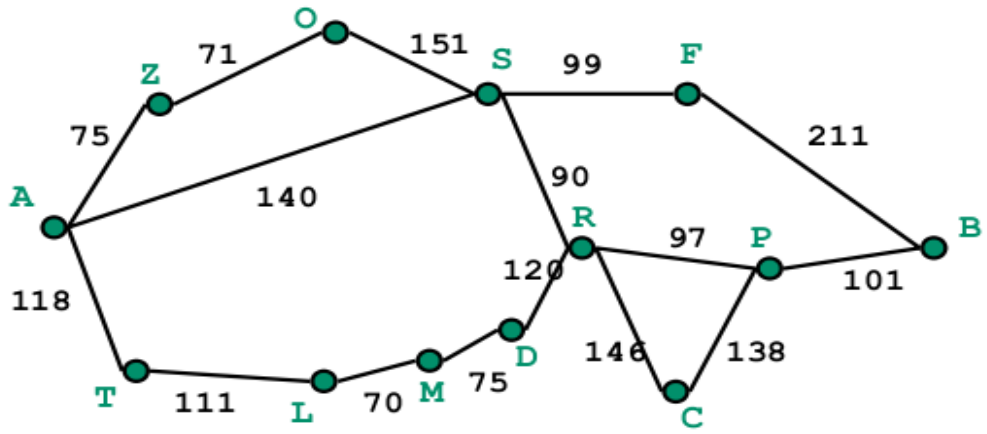
LOS	TZA
OFRLO	STZA
OFRL	OTZA



Uniform Cost Search

Example:

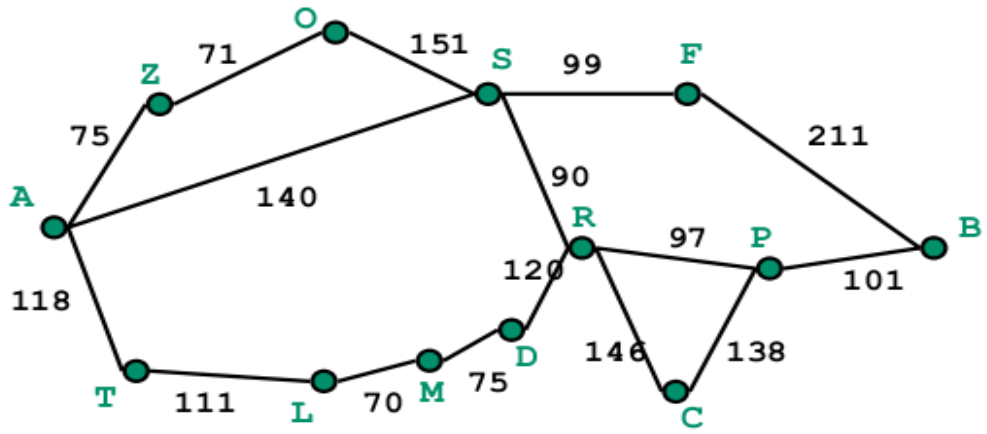
LOS	TZA
OFRLO	STZA
OFRL	OTZA
MOFR	LOTZA



Uniform Cost Search

Example:

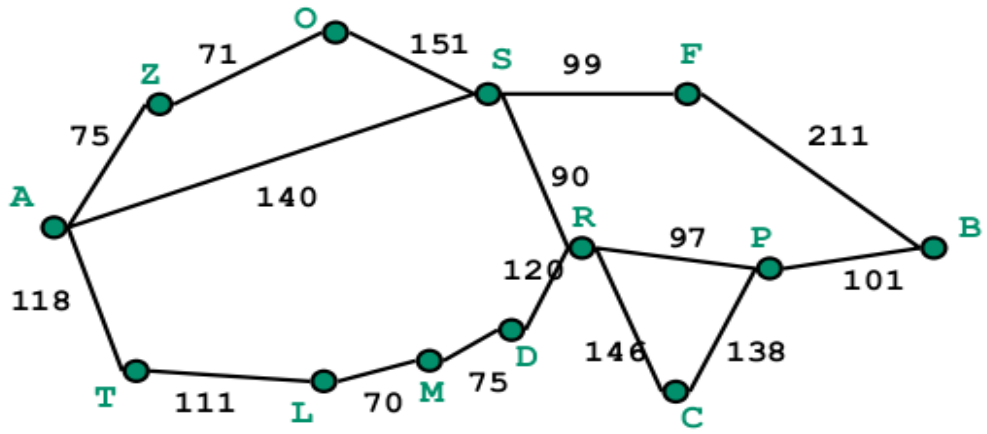
MOFR	LOTZA
CDPMOF	RLOTZA



Uniform Cost Search

Example:

MOFR	LOTZA
CDPMOF	RLOTZA
BCDPMO	FRLOTZA

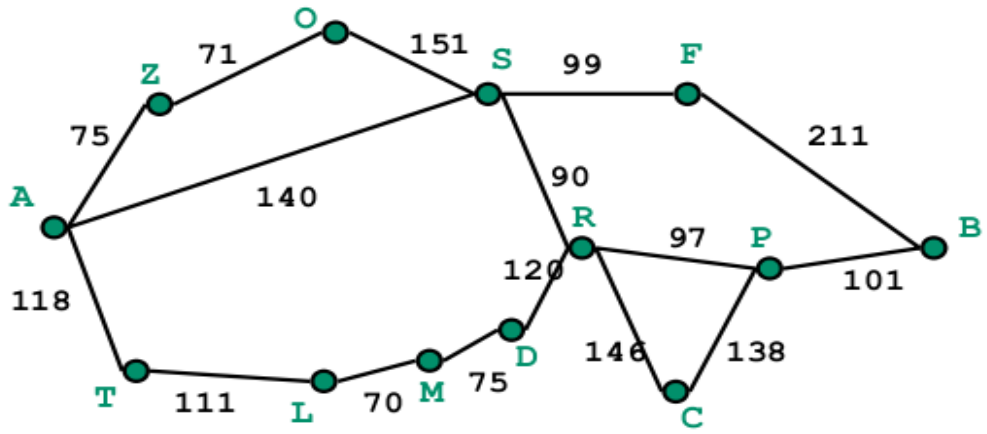


The target is already in the agenda. Do we stop here?

Uniform Cost Search

Example:

MOFR	LOTZA
CDPMOF	RLOTZA
BCDPMO	FRLOTZA

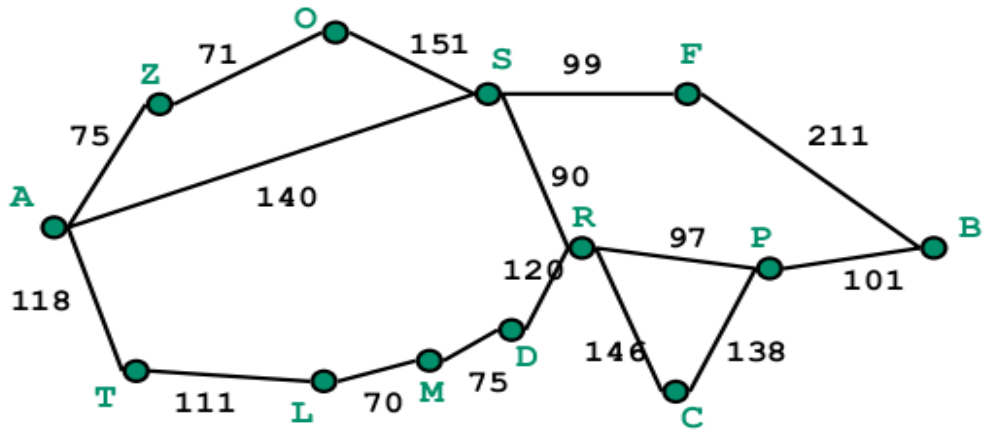


But eventually, we will get to another B via S, R and P.

Uniform Cost Search

Example:

MOFR	LOTZA
CDPMOF	RLOTZA
BCDPMO	FRLOTZA
BCDPM	OFRLOTZA



Uniform Cost Search

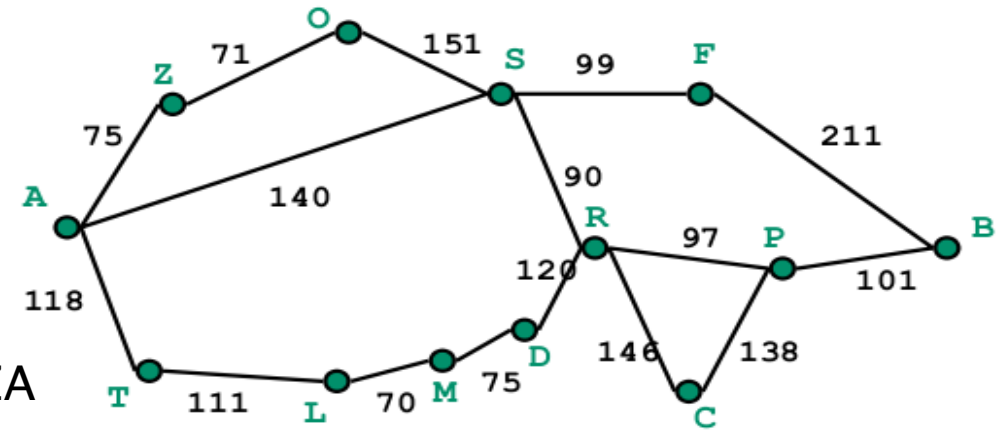
Example:

BCDPM

DBCDP

OFRLOTZA

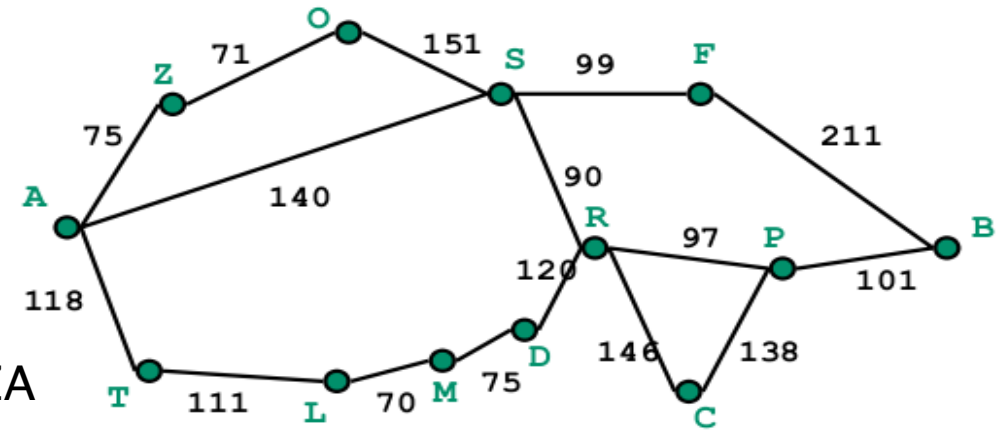
MOFRLOTZA



Uniform Cost Search

Example:

BCDPM	OFRLOTZA
DBCDP	MOFRLOTZA
CBBCD	PMOFRLOTZA



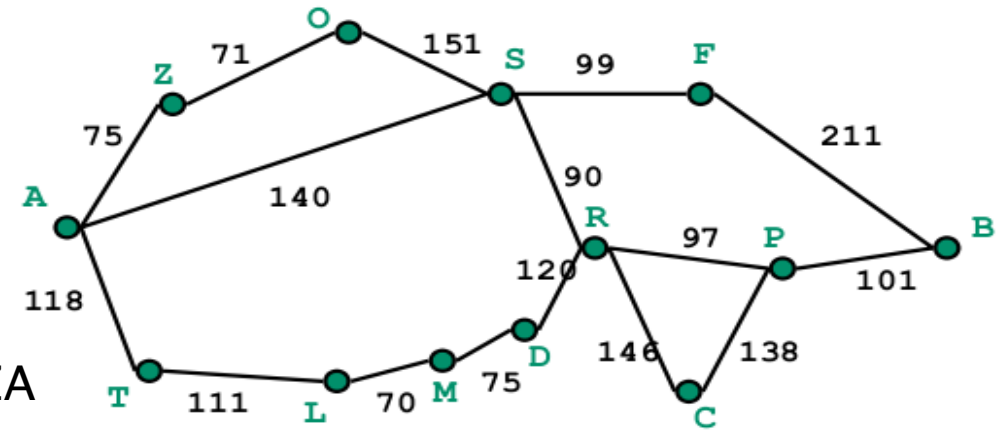
Uniform Cost Search

Example:

BCDPM

DBCDP

CBBCD



OFRLOTZA

MOFRLOTZA

PMOFRLOTZA

ASRPB = 428

ASFB = 140

Uniform Cost Search

Example:

BCDPM

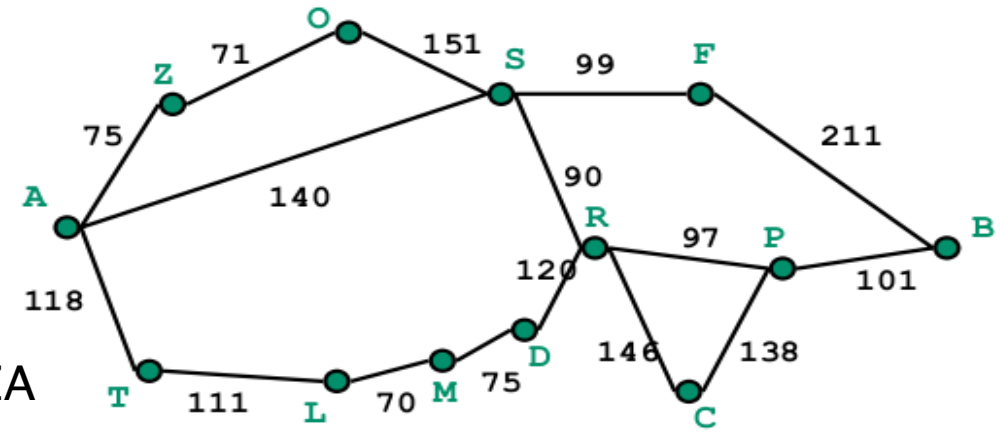
DBCDP

CBBCD

OFRLOTZA

MOFRLOTZA

PMOFRLOTZA



ASRPB = 428

ASFB = 140

It turns out that the first goal node that we remove from the agenda is the shortest path.