COMP3270 1920 Chapter 1 Teacher Notes

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Answer to Task: A has more states than B.

A has 64*63*62*61*60*59*58*57 states for the 8 queens problem. I don't know how many state B has for the 8 queens problem.

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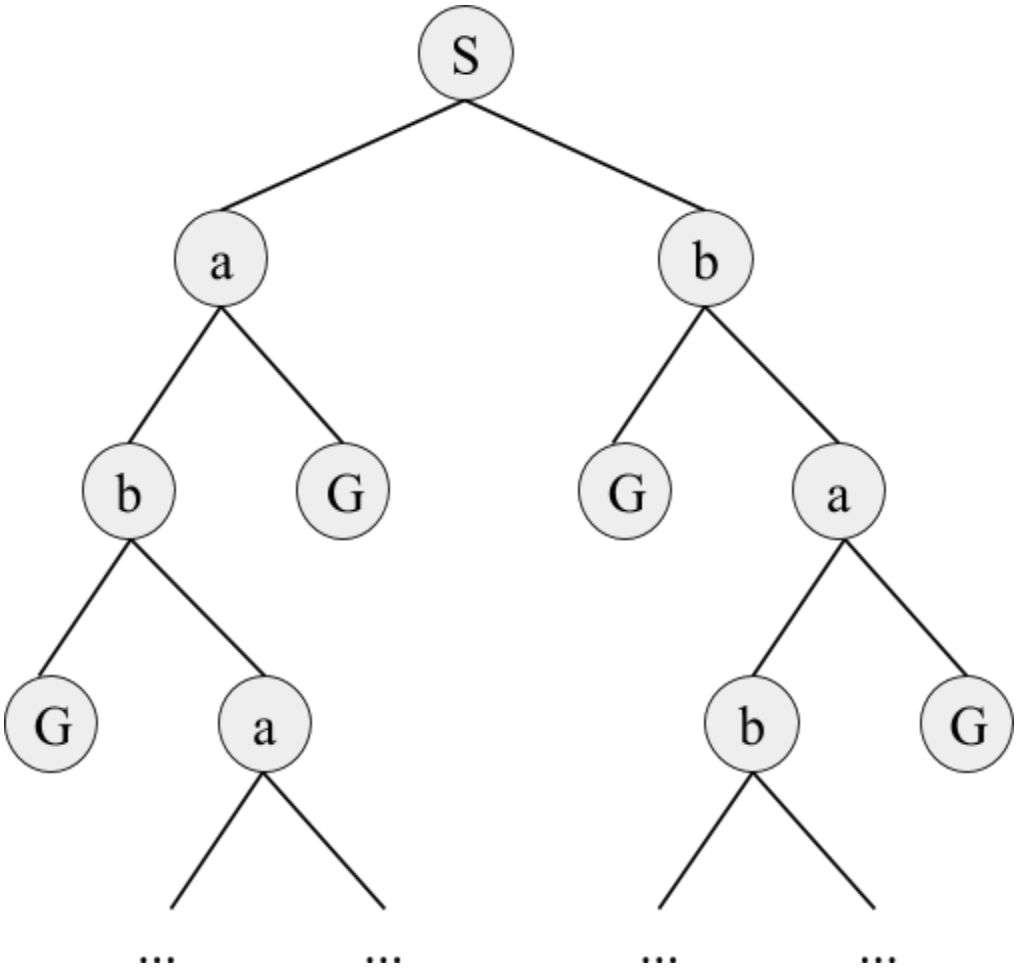
Answer to Task: The complete search tree has infinite many nodes in it and cannot be drawn.



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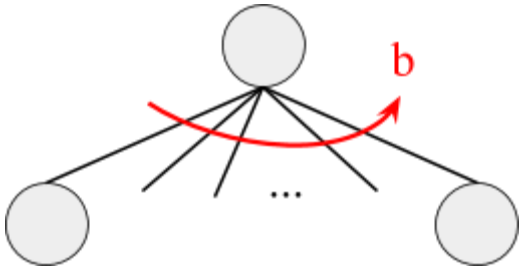
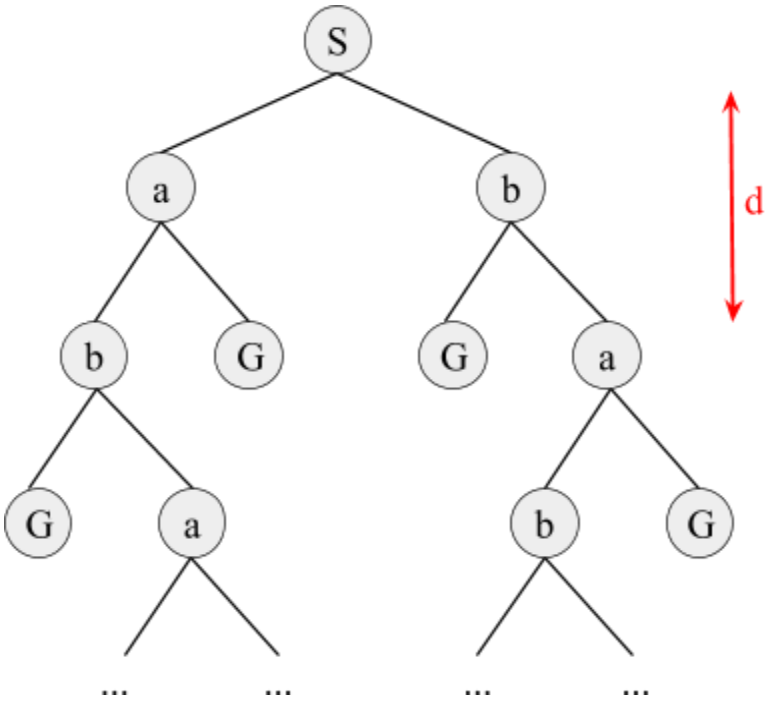
b: max branching Factor



d: distance to root of shallowest solution



m: maximum length of any path in the state space

m is infinite in the example above in infinite!

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Deque: (pronounce: deck) double-ended queue.

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Yes, here is the complete run:

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Initial frontier: ['A']
Exploring: A ...
['AS', 'AT', 'AZ']
Exploring: S ...
['AT', 'AZ', 'ASA', 'ASF', 'ASO', 'ASR']
Exploring: T ...
['AZ', 'ASA', 'ASF', 'ASO', 'ASR', 'ATA', 'ATL']
Exploring: Z ...
['ASA', 'ASF', 'ASO', 'ASR', 'ATA', 'ATL', 'AZA', 'AZO']
Exploring: A ...
['ASF', 'ASO', 'ASR', 'ATA', 'ATL', 'AZA', 'AZO', 'ASAS', 'ASAT', 'ASAZ']
Exploring: F ...
['ASO', 'ASR', 'ATA', 'ATL', 'AZA', 'AZO', 'ASAS', 'ASAT', 'ASAZ', 'ASFB',
'ASFS']
Exploring: O ...
['ASR', 'ATA', 'ATL', 'AZA', 'AZO', 'ASAS', 'ASAT', 'ASAZ', 'ASFB', 'ASFS',
'ASOS', 'ASOZ']
Exploring: R ...
['ATA', 'ATL', 'AZA', 'AZO', 'ASAS', 'ASAT', 'ASAZ', 'ASFB', 'ASFS',
'ASOS', 'ASOZ', 'ASRC', 'ASRP', 'ASRS']
Exploring: A ...
['ATL', 'AZA', 'AZO', 'ASAS', 'ASAT', 'ASAZ', 'ASFB', 'ASFS', 'ASOS',
'ASOZ', 'ASRC', 'ASRP', 'ASRS', 'ATAS', 'ATAT', 'ATAZ']
Exploring: L ...
['AZA', 'AZO', 'ASAS', 'ASAT', 'ASAZ', 'ASFB', 'ASFS', 'ASOS', 'ASOZ',
'ASRC', 'ASRP', 'ASRS', 'ATAS', 'ATAT', 'ATAZ', 'ATLM', 'ATLT']
Exploring: A ...
['AZO', 'ASAS', 'ASAT', 'ASAZ', 'ASFB', 'ASFS', 'ASOS', 'ASOZ', 'ASRC',
'ASRP', 'ASRS', 'ATAS', 'ATAT', 'ATAZ', 'ATLM', 'ATLT', 'AZAS', 'AZAT',
'AZAZ']
Exploring: O ...
['ASAS', 'ASAT', 'ASAZ', 'ASFB', 'ASFS', 'ASOS', 'ASOZ', 'ASRC', 'ASRP',
'ASRS', 'ATAS', 'ATAT', 'ATAZ', 'ATLM', 'ATLT', 'AZAS', 'AZAT', 'AZAZ',
'AZOS', 'AZOZ']
```

```
Exploring: S ...
['ASAT', 'ASAZ', 'ASFB', 'ASFS', 'ASOS', 'ASOZ', 'ASRC', 'ASRP', 'ASRS',
'ATAS', 'ATAT', 'ATAZ', 'ATLM', 'ATLT', 'AZAS', 'AZAT', 'AZAZ', 'AZOS',
'AZOZ', 'ASASA', 'ASASF', 'ASASO', 'ASASR']
Exploring: T ...
['ASAZ', 'ASFB', 'ASFS', 'ASOS', 'ASOZ', 'ASRC', 'ASRP', 'ASRS', 'ATAS',
'ATAT', 'ATAZ', 'ATLM', 'ATLT', 'AZAS', 'AZAT', 'AZAZ', 'AZOS', 'AZOZ',
'ASASA', 'ASASF', 'ASASO', 'ASASR', 'ASATA', 'ASATL']
Exploring: Z ...
['ASFB', 'ASFS', 'ASOS', 'ASOZ', 'ASRC', 'ASRP', 'ASRS', 'ATAS', 'ATAT',
'ATAZ', 'ATLM', 'ATLT', 'AZAS', 'AZAT', 'AZAZ', 'AZOS', 'AZOZ', 'ASASA',
'ASASF', 'ASASO', 'ASASR', 'ASATA', 'ASATL', 'ASAZA', 'ASAZO']
Solution path: ASFB
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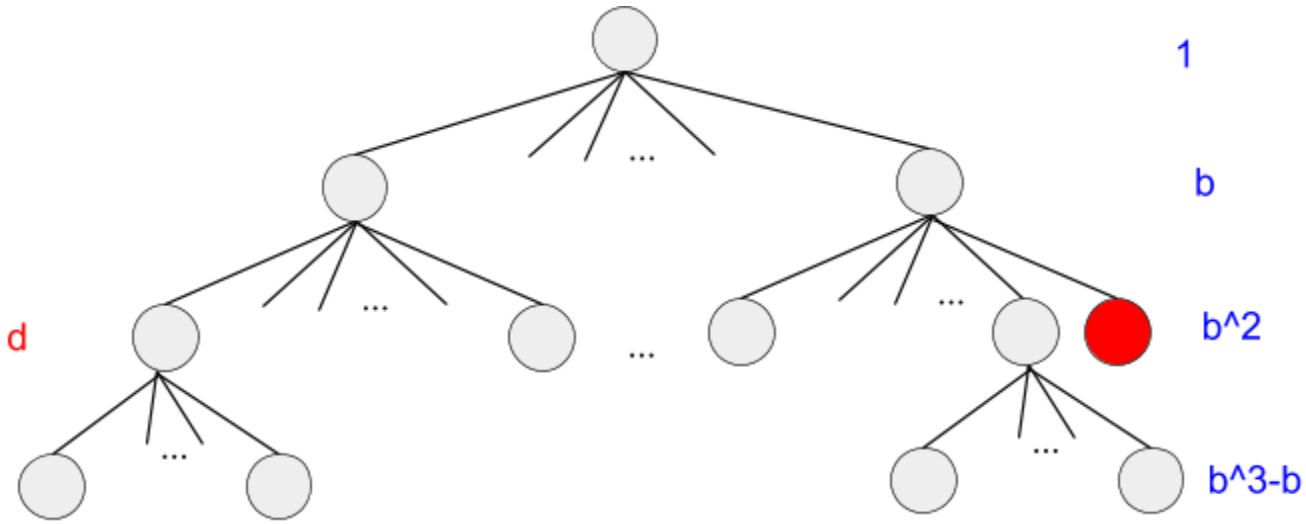
Assume TSA version is used

Complete: If b and d are finite it is complete.
Optimal: For constant cost, breadth-first search is optimal. For other cases it is not in general.

Complexity
Time:
In the worst case we are generating almost all nodes at depth d+1.Therefore total number of nodes generated is $O(b^{d+1})$.
Space: Same because number of nodes generated = number of nodes in memory $O(b^{d+1})$.



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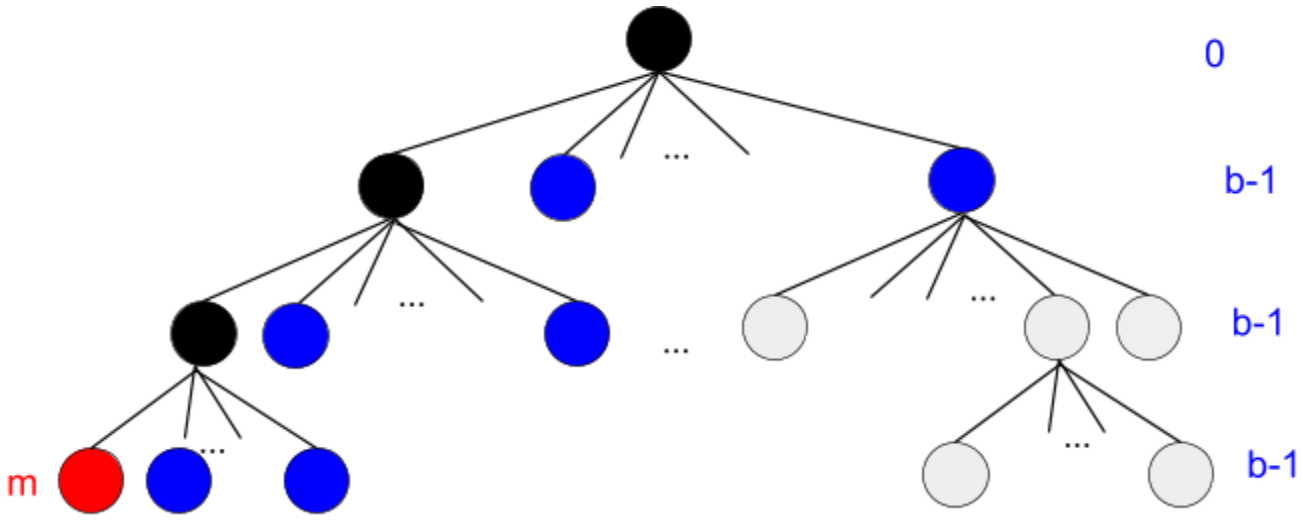
Assume TSA version is used

Complete: May fail in spaces with loops
Optimal: No, returns the first solution in finds
Time: $O(b^m)$ You have to look at everything, in the worst case
Space: $O(bm)$



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Assume TSA version is used

Complete: Yes if every cost is positive
Optimal: Yes, nodes expand in increasing order of cost
Time: $O(b^{\lfloor C^*/\epsilon \rfloor + 1})$
Space: $O(b^{\lfloor C^*/\epsilon \rfloor + 1})$

Floor function

C*: cost of optimal solution
epsilon: smallest path cost in search graph

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L>R?

1 / (Pacman's distance to the nearest food pellet)
L: 1/3
R: 1/2

Pacman's distance to the nearest ghost
L: 7
R: 3
L>R

Pacman's distance to the nearest ghost + 1 / (Pacman's distance to the nearest food pellet)
L: 7 + 1/3
R: 3 + 1/2
L>R

Pacman's distance to the nearest ghost + 1000 / (Pacman's distance to the nearest food pellet)
L: 7 + 1000/3
R: 3 + 1000/2

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