CS540: HW1 (P1)

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(a) The trace for the state of the priority queue is as follows:

Expanding	Frontier	Explored
	{[b,b,r,o]}	{}
[b,b,r,o]	{ 1:[b,b,o,r], 2:[b,o,r,b]}	{}
[b,b,o,r]	{ 2:[b,o,r,b], 2:[b,o,b,r], 3:[o,b,b,r]}	{[b,b,r,o]}
[b,o,r,b]	{ 2:[b,o,b,r], 3:[o,b,b,r], 3:[o,b,r,b], 3:[b,r,o,b]}	{[b,b,r,o], [b,b,o,r]}
[b,o,b,r]	{ 3:[o,b,b,r], 3:[o,b,r,b], 3:[b,r,o,b], 4:[b,r,b,o]}	{[b,b,r,o], [b,b,o,r], [b,o,r,b]}
[o,b,b,r]	{ 3:[o,b,r,b], 3:[b,r,o,b], 4:[b,r,b,o]}	{[b,b,r,o], [b,b,o,r], [b,o,r,b], [b,o,b,r]}
[o,b,r,b]	{ 3:[b,r,o,b], 4:[b,r,b,o], 5:[r,b,o,b]}	{[b,b,r,o], [b,b,o,r], [b,o,r,b], [b,o,b,r], [o,b,b,r]}
[b,r,o,b]	{ 4:[b,r,b,o], 5:[r,b,o,b], 5:[o,r,b,b]}	{[b,b,r,o], [b,b,o,r], [b,o,r,b], [b,o,b,r], [o,b,b,r], [o,b,r,b]}
[b,r,b,o]	{ 5:[r,b,o,b], 5:[o,r,b,b]}	{[b,b,r,o], [b,b,o,r], [b,o,r,b], [b,o,b,r], [o,b,b,r], [o,b,r,b], [b,r,o,b]}
[r,b,o,b]		

Hence, the first lowest-cost goal state is [r,b,o,b] with a cost of 5.

(b) The first part of the trace for the priority queue is the same as above, with the following additional steps:

Expanding	Frontier	Explored
[r,b,o,b]	{ 5:[o,r,b,b], 6: [r,o,b,b], 6: [r,b,b,o]}	{[b,b,r,o], [b,b,o,r], [b,o,r,b], [b,o,b,r], [o,b,b,r], [o,b,r,b], [b,r,o,b], [b,r,b,o]}
[o,r,b,b]	{ 6: [r,o,b,b], 6: [r,b,b,o], }	{[b,b,r,o], [b,b,o,r], [b,o,r,b], [b,o,b,r], [o,b,b,r], [o,b,r,b], [b,r,o,b], [b,r,b,o], [r,b,o,b]}

So, [r,b,o,b] and [o,r,b,b] are the two lowest-cost goal states (since the only remaining states on the queue have a cost > 5, we know that no successors of theirs can have cost ≤ 5), each with a cost of 5, and their paths are as follows:

i. [b,b,r,o] $\rightarrow$ [b,o,r,b] (+2) $\rightarrow$ [o,b,r,b] (+1) $\rightarrow$ [r,b,o,b] (+2)

ii. [b,b,r,o] $\rightarrow$ [b,o,r,b] (+2) $\rightarrow$ [b,r,o,b] (+1) $\rightarrow$ [o,r,b,b] (+2)