

Raelyn Mendoza
CS 404 – Homework 5
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1. Did the number of the checked nodes counted by the Hamiltonian method change every time? Explain your observation.

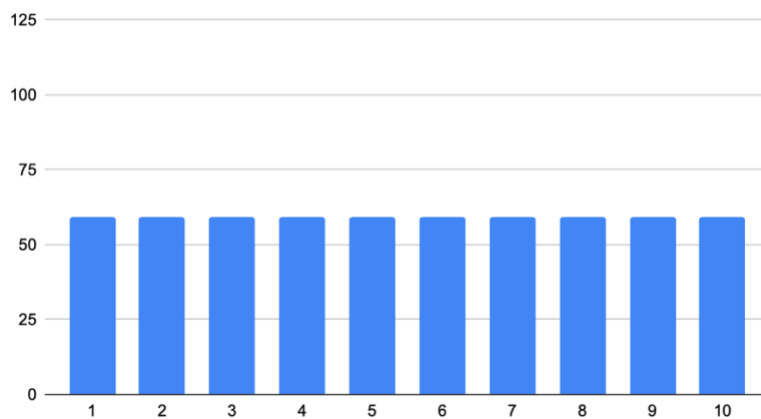
No, the number of checked nodes counted by the Hamiltonian method did not change every time the program was run.

2. Did the number of nodes estimated by the Monte Carlo approach change every time? Explain your observation.

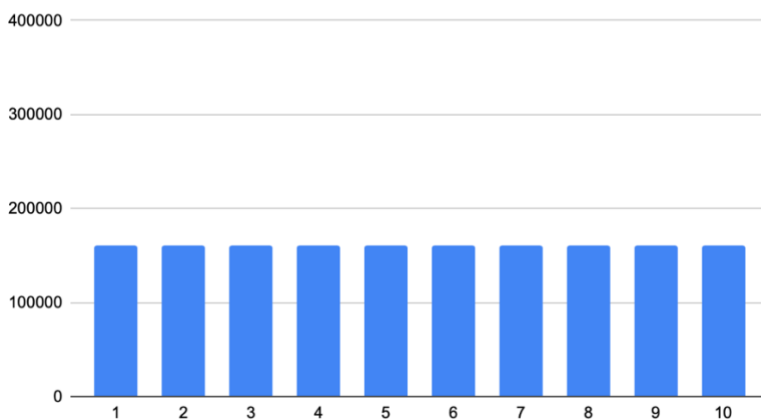
No, the number of nodes estimated by the Monte Carlo approach did not change every time. Over the 10 times the program was run for $n = 5$ the number of nodes remained at 59. The number of nodes for $n = 8$ was 160133.

3. For each graph (represented by W), plot a bar chart that shows the numbers you obtained from question 2. Since there are two graphs in the test driver (one has 5 vertices and the other has 8 vertices), you need to plot two separate charts.

Estimated nodes for $n = 5$



Estimated nodes for $n = 8$



4. Compute the total number of nodes in the state space tree for both graphs using the formula presented on page 233 in the textbook and compare these numbers with the one you obtained from questions 1 and 2. What do you find?

$$\frac{(n-1)^n - 1}{n-2}$$

n = 5

$$\frac{(5-1)^5 - 1}{5-2} = \frac{(4)^5 - 1}{3} = \frac{1024-1}{3} = \frac{1023}{3} = 341$$

n = 8

$$\frac{(8-1)^8 - 1}{8-2} = \frac{(7)^8 - 1}{6} = \frac{5764801-1}{6} = \frac{5764800}{6} = 960800$$

For n = 5, the number I received using the formula was larger than the estimated number of nodes checked using the Monte Carlo and Hamiltonian Algorithms.

For n = 8, the number I received for the Monte Carlo estimate algorithm was small than the number given by the formula, however, they were still in the hundred thousand. The number given by the Hamiltonian algorithm was drastically smaller than both numbers.

Output 1:

Mendoza_Raelyn_CS404_HW5 TestHomework5

Test 1:

W1 =

T	T	F	F	T
T	T	T	T	T
F	T	T	T	F
F	T	T	T	F
T	T	F	F	T

- hamiltonian(0) on W1:

- estimateHamiltonian(5, W1):

Expected: # of checked nodes = 45 [Passed]

Yours: # of checked nodes: 45, # of estimated checked nodes: 59

Test 2:

W2 =

T	T	T	F	F	F	F	T
T	T	T	F	F	F	T	T
T	T	T	T	F	T	F	F
F	F	T	T	T	F	F	F
F	F	F	T	T	T	F	F
F	F	T	F	T	T	T	F
T	T	F	F	F	F	T	T
T	T	F	F	F	F	T	T

- hamiltonian(0) on W2:

Solution: [1, 2, 3, 4, 5, 6, 7, 8]

Solution: [1, 3, 4, 5, 6, 7, 2, 8]

Solution: [1, 3, 4, 5, 6, 7, 8, 2]

Solution: [1, 8, 2, 3, 4, 5, 6, 7]

- estimateHamiltonian(8, W2):

Expected: # of checked nodes = 379 [Passed]

Yours: # of checked nodes: 379, # of estimated checked nodes: 160133

Process finished with exit code 0

Output 2:

Test 1:

W1 =

T	T	F	F	T
T	T	T	T	T
F	T	T	T	F
F	T	T	T	F
T	T	F	F	T

- hamiltonian(0) on W1:

- estimateHamiltonian(5, W1):

Expected: # of checked nodes = 45 [Passed]

Yours: # of checked nodes: 45, # of estimated checked nodes: 59

Test 2:

W2 =

T	T	T	F	F	F	F	T
T	T	T	F	F	F	T	T
T	T	T	T	F	T	F	F
F	F	T	T	T	F	F	F
F	F	F	T	T	T	F	F
F	F	T	F	T	T	T	F
T	T	F	F	F	F	T	T
T	T	F	F	F	F	T	T

- hamiltonian(0) on W2:

Solution: [1, 2, 3, 4, 5, 6, 7, 8]

Solution: [1, 3, 4, 5, 6, 7, 2, 8]

Solution: [1, 3, 4, 5, 6, 7, 8, 2]

Solution: [1, 8, 2, 3, 4, 5, 6, 7]

- estimateHamiltonian(8, W2):

Expected: # of checked nodes = 379 [Passed]

Yours: # of checked nodes: 379, # of estimated checked nodes: 160133

Process finished with exit code 0

Output 3:

Test 1:

W1 =

T	T	F	F	T
T	T	T	T	T
F	T	T	T	F
F	T	T	T	F
T	T	F	F	T

- hamiltonian(0) on W1:

- estimateHamiltonian(5, W1):

Expected: # of checked nodes = 45 [Passed]

Yours: # of checked nodes: 45, # of estimated checked nodes: 59

Test 2:

W2 =

T	T	T	F	F	F	F	T
T	T	T	F	F	F	T	T
T	T	T	T	F	T	F	F
F	F	T	T	T	F	F	F
F	F	F	T	T	T	F	F
F	F	T	F	T	T	T	F
T	T	F	F	F	F	T	T
T	T	F	F	F	F	T	T

- hamiltonian(0) on W2:

Solution: [1, 2, 3, 4, 5, 6, 7, 8]

Solution: [1, 3, 4, 5, 6, 7, 2, 8]

Solution: [1, 3, 4, 5, 6, 7, 8, 2]

Solution: [1, 8, 2, 3, 4, 5, 6, 7]

- estimateHamiltonian(8, W2):

Expected: # of checked nodes = 379 [Passed]

Yours: # of checked nodes: 379, # of estimated checked nodes: 160133

Process finished with exit code 0

Output 4:

Test 1:

W1 =

T	T	F	F	T
T	T	T	T	T
F	T	T	T	F
F	T	T	T	F
T	T	F	F	T

- hamiltonian(0) on W1:

- estimateHamiltonian(5, W1):

Expected: # of checked nodes = 45 [Passed]

Yours: # of checked nodes: 45, # of estimated checked nodes: 59

Test 2:

W2 =

T	T	T	F	F	F	F	T
T	T	T	F	F	F	T	T
T	T	T	T	F	T	F	F
F	F	T	T	T	F	F	F
F	F	F	T	T	T	F	F
F	F	T	F	T	T	T	F
T	T	F	F	F	F	T	T
T	T	F	F	F	F	T	T

- hamiltonian(0) on W2:

Solution: [1, 2, 3, 4, 5, 6, 7, 8]

Solution: [1, 3, 4, 5, 6, 7, 2, 8]

Solution: [1, 3, 4, 5, 6, 7, 8, 2]

Solution: [1, 8, 2, 3, 4, 5, 6, 7]

- estimateHamiltonian(8, W2):

Expected: # of checked nodes = 379 [Passed]

Yours: # of checked nodes: 379, # of estimated checked nodes: 160133

Process finished with exit code 0

Output 5:

Test 1:

W1 =

T	T	F	F	T
T	T	T	T	T
F	T	T	T	F
F	T	T	T	F
T	T	F	F	T

- hamiltonian(0) on W1:

- estimateHamiltonian(5, W1):

Expected: # of checked nodes = 45 [Passed]

Yours: # of checked nodes: 45, # of estimated checked nodes: 59

Test 2:

W2 =

T	T	T	F	F	F	F	T
T	T	T	F	F	F	T	T
T	T	T	T	F	T	F	F
F	F	T	T	T	F	F	F
F	F	F	T	T	T	F	F
F	F	T	F	T	T	T	F
T	T	F	F	F	F	T	T
T	T	F	F	F	F	T	T

- hamiltonian(0) on W2:

Solution: [1, 2, 3, 4, 5, 6, 7, 8]

Solution: [1, 3, 4, 5, 6, 7, 2, 8]

Solution: [1, 3, 4, 5, 6, 7, 8, 2]

Solution: [1, 8, 2, 3, 4, 5, 6, 7]

- estimateHamiltonian(8, W2):

Expected: # of checked nodes = 379 [Passed]

Yours: # of checked nodes: 379, # of estimated checked nodes: 160133

Process finished with exit code 0

Output 6:

Test 1:

W1 =

T	T	F	F	T
T	T	T	T	T
F	T	T	T	F
F	T	T	T	F
T	T	F	F	T

- hamiltonian(0) on W1:

- estimateHamiltonian(5, W1):

Expected: # of checked nodes = 45 [Passed]

Yours: # of checked nodes: 45, # of estimated checked nodes: 59

Test 2:

W2 =

T	T	T	F	F	F	F	T
T	T	T	F	F	F	T	T
T	T	T	T	F	T	F	F
F	F	T	T	T	F	F	F
F	F	F	T	T	T	F	F
F	F	T	F	T	T	T	F
T	T	F	F	F	F	T	T
T	T	F	F	F	F	T	T

- hamiltonian(0) on W2:

Solution: [1, 2, 3, 4, 5, 6, 7, 8]

Solution: [1, 3, 4, 5, 6, 7, 2, 8]

Solution: [1, 3, 4, 5, 6, 7, 8, 2]

Solution: [1, 8, 2, 3, 4, 5, 6, 7]

- estimateHamiltonian(8, W2):

Expected: # of checked nodes = 379 [Passed]

Yours: # of checked nodes: 379, # of estimated checked nodes: 160133

Process finished with exit code 0

Output 7:

Test 1:

W1 =

T	T	F	F	T
T	T	T	T	T
F	T	T	T	F
F	T	T	T	F
T	T	F	F	T

- hamiltonian(0) on W1:

- estimateHamiltonian(5, W1):

Expected: # of checked nodes = 45 [Passed]

Yours: # of checked nodes: 45, # of estimated checked nodes: 59

Test 2:

W2 =

T	T	T	F	F	F	F	T
T	T	T	F	F	F	T	T
T	T	T	T	F	T	F	F
F	F	T	T	T	F	F	F
F	F	F	T	T	T	F	F
F	F	T	F	T	T	T	F
T	T	F	F	F	F	T	T
T	T	F	F	F	F	T	T

- hamiltonian(0) on W2:

Solution: [1, 2, 3, 4, 5, 6, 7, 8]

Solution: [1, 3, 4, 5, 6, 7, 2, 8]

Solution: [1, 3, 4, 5, 6, 7, 8, 2]

Solution: [1, 8, 2, 3, 4, 5, 6, 7]

- estimateHamiltonian(8, W2):

Expected: # of checked nodes = 379 [Passed]

Yours: # of checked nodes: 379, # of estimated checked nodes: 160133

Process finished with exit code 0

Output 8:

Test 1:

W1 =

T	T	F	F	T
T	T	T	T	T
F	T	T	T	F
F	T	T	T	F
T	T	F	F	T

- hamiltonian(0) on W1:

- estimateHamiltonian(5, W1):

Expected: # of checked nodes = 45 [Passed]

Yours: # of checked nodes: 45, # of estimated checked nodes: 59

Test 2:

W2 =

T	T	T	F	F	F	F	T
T	T	T	F	F	F	T	T
T	T	T	T	F	T	F	F
F	F	T	T	T	F	F	F
F	F	F	T	T	T	F	F
F	F	T	F	T	T	T	F
T	T	F	F	F	F	T	T
T	T	F	F	F	F	T	T

- hamiltonian(0) on W2:

Solution: [1, 2, 3, 4, 5, 6, 7, 8]

Solution: [1, 3, 4, 5, 6, 7, 2, 8]

Solution: [1, 3, 4, 5, 6, 7, 8, 2]

Solution: [1, 8, 2, 3, 4, 5, 6, 7]

- estimateHamiltonian(8, W2):

Expected: # of checked nodes = 379 [Passed]

Yours: # of checked nodes: 379, # of estimated checked nodes: 160133

Process finished with exit code 0

Output 9:

Test 1:

W1 =

T	T	F	F	T
T	T	T	T	T
F	T	T	T	F
F	T	T	T	F
T	T	F	F	T

- hamiltonian(0) on W1:

- estimateHamiltonian(5, W1):

Expected: # of checked nodes = 45 [Passed]

Yours: # of checked nodes: 45, # of estimated checked nodes: 59

Test 2:

W2 =

T	T	T	F	F	F	F	T
T	T	T	F	F	F	T	T
T	T	T	T	F	T	F	F
F	F	T	T	T	F	F	F
F	F	F	T	T	T	F	F
F	F	T	F	T	T	T	F
T	T	F	F	F	F	T	T
T	T	F	F	F	F	T	T

- hamiltonian(0) on W2:

Solution: [1, 2, 3, 4, 5, 6, 7, 8]

Solution: [1, 3, 4, 5, 6, 7, 2, 8]

Solution: [1, 3, 4, 5, 6, 7, 8, 2]

Solution: [1, 8, 2, 3, 4, 5, 6, 7]

- estimateHamiltonian(8, W2):

Expected: # of checked nodes = 379 [Passed]

Yours: # of checked nodes: 379, # of estimated checked nodes: 160133

Process finished with exit code 0

Output 10:

Test 1:

W1 =

T	T	F	F	T
T	T	T	T	T
F	T	T	T	F
F	T	T	T	F
T	T	F	F	T

- hamiltonian(0) on W1:

- estimateHamiltonian(5, W1):

Expected: # of checked nodes = 45 [Passed]

Yours: # of checked nodes: 45, # of estimated checked nodes: 59

Test 2:

W2 =

T	T	T	F	F	F	F	T
T	T	T	F	F	F	T	T
T	T	T	T	F	T	F	F
F	F	T	T	T	F	F	F
F	F	F	T	T	T	F	F
F	F	T	F	T	T	T	F
T	T	F	F	F	F	T	T
T	T	F	F	F	F	T	T

- hamiltonian(0) on W2:

Solution: [1, 2, 3, 4, 5, 6, 7, 8]

Solution: [1, 3, 4, 5, 6, 7, 2, 8]

Solution: [1, 3, 4, 5, 6, 7, 8, 2]

Solution: [1, 8, 2, 3, 4, 5, 6, 7]

- estimateHamiltonian(8, W2):

Expected: # of checked nodes = 379 [Passed]

Yours: # of checked nodes: 379, # of estimated checked nodes: 160133

Process finished with exit code 0