

You are going to estimate, by hand, the size of the backtrack tree for an uncrossed knight's tour. Go to the bottom of the course website to get your first starting position and offset for counting knight moves. Use your first and last names as listed in ELMS. Use the boards provided to draw your knight's tours as Knuth does. You can use the boards with or without the dots in the middle of the squares, whichever is easier.

8								
7		8		1				
6	7				2			
5			●					
4	6				3			
3		5		4				
2								
1								
	A	B	C	D	E	F	G	H

Use the knight's tour program on the website. To pick a knight move see how many possible moves there are. Go to the list in the back of this page to find the first unused random number for that value. Cross it off. When you count, start from your offset value and count clockwise to find your random jump. The square for your offset value is associated with the random number 1. For example, if your offset value is 4 and your random number is 3, then start down 2 and right 1 from the current knight position and move the knight to the third legal move counting clockwise. (Down 2 and right 1 is the first move, although it may not be a legal move.)

To start your next experiment, find the next two numbers in the 1-8 list (and cross them off). Consider where your knight landed at the end of the last experiment. Add the first number to the column value, moving *right* exactly that number of squares, circling around (back to the left) if you need to. Add the second number to the row value, moving *up* exactly that number of squares, circling around (back to the bottom) if you need to. (In both cases, 8 will bring you back to where you started.) This is the starting position for your next experiment. It will be random.

Do four experiments. It is important that you do this very **carefully**, so that your estimate is valid and that we can check your answers.

1. Write your name as appears on ELMS neatly and clearly.
2. Write your three values neatly and clearly.
3. Run four experiments. Draw the four boards.
4. Write down your branching factors for each experiment. Note that there is an implicit branching factor of 64 for each experiment from picking the start square, which you should include.
5. For each experiment, calculate the expected number of nodes for each level, from the data of your experiment. (NOTE: The root has 1 node, and the next level has 64 nodes.)
6. Average your four experiments for each level to calculate the expected number of nodes for each level. Round each value to the nearest integer.
7. On a scale of 1 to 10 how much fun did you have?

EXAMPLE:

I type Clyde Kruskal and get back: B, 2, 3.

My start location is B2, and my offset is 3.

Four legal moves: (D1, A4, C4, D3.) Next random number in 1-4: 1. Jump to D1.

Three legal moves: Next random number in 1-3: 2. Jump to E3.

Seven legal moves: Next random number in 1-7: 2. Jump to F1.

Two legal moves: Next random number in 1-2: 2. Jump to H2.

Two legal moves: Next random number in 1-2: 1. Jump to F3.

Four legal moves: Next random number in 1-4: 1. Jump to D4.

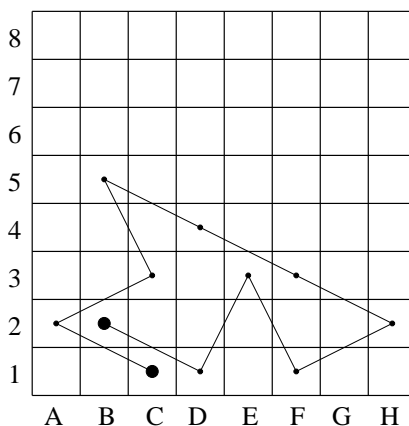
Six legal moves: Next random number in 1-6: 3. Jump to B5.

Five legal moves: Next random number in 1-5: 1. Jump to C3.

Two legal moves: Next random number in 1-2: 1. Jump to A2.

Two legal moves: Next random number in 1-2: 1. Jump to C1.

No legal moves: Done.



Ended on C1. Next two random numbers in 1-8: 7, 5. New column B. New row 6.

Branching factors: 1, 64, 4, 3, 7, 2, 2, 4, 6, 5, 2, 2

Estimated nodes: 1, 64, 256, 768, 5376, 10752, 21504, 86016, 516096, 2580480, 5160960, 10321920

1-2:

2 1 1 1 1 2 1 2 2 2 2 2 1 1 1 2 2 2 1 2
1 1 2 1 1 2 1 1 2 1 1 1 1 2 1 2 2 1 1 2
2 1 1 1 2 2 1 1 1 1 1 2 1 2 1 1 1 2 1 2
2 2 1 1 2 1 1 2 1 2 1 2 1 1 2 2 1 1 2 2
2 2 1 1 1 2 1 2 1 1 1 1 2 1 2 2 2 1 2 1

1-3:

2 3 2 3 2 3 1 2 1 1 3 1 1 3 2 3 1 1 1 1
2 2 2 1 3 3 2 2 2 1 3 2 1 3 1 1 2 3 1 2
3 2 3 2 1 1 3 1 2 2 2 3 2 1 1 1 3 2 2 2
3 1 2 2 1 2 2 3 1 3 1 2 2 2 1 2 2 2 1 2

1-4:

1 1 2 1 3 3 1 1 3 2 2 2 3 4 1 4 4 4 1 4
3 4 3 2 3 2 4 3 1 2 4 1 1 2 1 3 1 1 4 2
3 4 2 4 2 3 4 3 1 2 2 2 4 4 4 1 4 1 2 2
3 3 4 3 1 3 1 3 1 1 1 3 1 2 3 1 4 3 3 2

1-5:

1 4 2 5 2 4 4 3 1 3 3 2 3 1 1 1 3 3 3 2
4 1 3 2 4 3 5 3 4 1 2 3 1 3 2 5 5 4 4 4
5 1 1 2 1 2 1 1 1 4 4 2 3 4 3 5 5 5 3 4

1-6:

3 4 6 5 6 3 1 6 5 3 1 1 2 6 5 6 1 3 3 4
3 3 4 3 3 6 6 5 3 5 2 2 6 3 6 1 3 3 6 2
5 6 6 3 5 5 1 2 1 3 5 6 5 5 2 1 2 6 3 2

1-7:

2 2 2 7 3 3 2 2 1 5 7 7 7 3 3 6 3 5 4 4
2 5 2 4 1 7 5 4 4 4 2 3 5 1 6 3 5 1 2 1

1-8: 7 5 4 3 4 7 1 4 5 7 1 5 5 4 3 7 6 6 5 4
8 5 3 1 7 3 2 2 8 3 2 4 7 7 5 1 6 8 8 3

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5	•	•	•	•	•	•	•	•
4	•	•	•	•	•	•	•	•
3	•	•	•	•	•	•	•	•
2	•	•	•	•	•	•	•	•
1	•	•	•	•	•	•	•	•
	A	B	C	D	E	F	G	H

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5	•	•	•	•	•	•	•	•
4	•	•	•	•	•	•	•	•
3	•	•	•	•	•	•	•	•
2	•	•	•	•	•	•	•	•
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	A	B	C	D	E	F	G	H

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5	•	•	•	•	•	•	•	•
4	•	•	•	•	•	•	•	•
3	•	•	•	•	•	•	•	•
2	•	•	•	•	•	•	•	•
1	•	•	•	•	•	•	•	•
	A	B	C	D	E	F	G	H

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4	•	•	•	•	•	•	•	•
3	•	•	•	•	•	•	•	•
2	•	•	•	•	•	•	•	•
1	•	•	•	•	•	•	•	•
	A	B	C	D	E	F	G	H