

Exercise Solution for Recursion **without** Memoization

Round #	1	2	3	4	5	6	7	8
<i>n</i> (entered by you with button presses on Evo)	0	2	1	3	4	5	3	5
Your guess for the number of recursive calls this round								
<i>n!</i> (from Evo)	1	2	1	6	24	120	6	120
Recursive calls this round (from Evo)	0	2	1	3	4	5	3	5
Total recursive calls (from Evo)	0	2	3	6	10	15	18	23

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Round #	1	2	3	4	5	6	7	8
<i>n</i> (entered by you with button presses on Evo)	0	2	1	3	4	5	3	5
Your guess for the number of recursive calls this round								
<i>n!</i> (from Evo)	1	2	1	6	24	120	6	120
Recursive calls this round (from Evo)	0	2	0	1	1	1	0	0
Total recursive calls (from Evo)	0	2	2	3	4	5	5	5
memo[1] (from Evo)	0	1	1	1	1	1	1	1
memo[2] (from Evo)	0	2	2	2	2	2	2	2
memo[3] (from Evo)	0	0	0	6	6	6	6	6
memo[4] (from Evo)	0	0	0	0	24	24	24	24
memo[5] (from Evo)	0	0	0	0	0	120	120	120

Questions related to the table of Figure 5:

1. Why is there 0 recursive calls in round 1? *[0! is the base for this algorithm. 0! is defined as 1. Therefore , there is no recursive call within the function.]*
2. Why are there 0 recursive calls in round 3? *[1! was computed in round 2 recursively when 2! was requested. 1! = 1 was then stored in memo[1].]*
3. Why is there only 1 recursive call in round 4? *[The value for 2! and 1! have previously been stored in the memo array.]*
4. If we had done a round 9, how many recursive calls would that round have had and why? *[Zero recursive calls. All memo array values were filled in earlier rounds. In fact all memo array values were filled by the end of round 6. No more recursive calls were needed for rounds 7 and beyond.]*
5. No matter how large the number of rounds, what is the maximum number of **total recursive calls** that we would see? *[5 is the maximum number of total recursive calls that we would ever see.]*
6. Looking at efficiency, how do the total number of recursive calls for all 8 rounds compare for algorithm #1 and algorithm #2. *[There were 23 recursive calls for algorithm #1 and only 5 for the memoization algorithm. Quite a savings in computer cycles consumed!]*