Note: The last 8 points are based on the level of explanation, give partial as you see fit.

2) (10 pts) ANL (Algorithm Analysis)

A brute force algorithm which processes all permutations of *n* routines runs in $O(n \times (n!))$ time. On a particular computer, executing the algorithm for **n = 9** takes 180 milliseconds. How many seconds is the algorithm expected to take on an input of size **n = 11**, run on the same computer?

Let $T(n) = cn(n!)$ be the execution time for the algorithm run on an input of size n. Using the given information we have:

$$T(9) = c9(9!) = 180\ ms \rightarrow c = \frac{180\ ms}{9(9!)} = \frac{20\ ms}{9!}$$

Let's now solve for T(11):

$$\begin{aligned} T(11) = c(11)(11!) &= \frac{20ms}{9!} \times 11 \times 11! \\ &= 20ms \times \frac{11(11!)}{9!} \\ &= 20ms \times \frac{(11)9!(10)(11)}{9!} \\ &= 20ms \times 11 \times 10 \times 11 \\ &= 20ms \times 1210 \\ &= 24200ms \\ &= \boldsymbol{24.2\ seconds} \end{aligned}$$

Grading: 1 pt set up equation for c
3 pts solve for c, no simplification necessary
1 pt set up expression for T(11)
1 pt substitute value of c and 11
3 pts for algebraic simplification
1 pt converting to seconds