

## 2) (10 pts) ANL (Algorithm Analysis)

A backtracking solution took  $O(n(k^n))$  time where  $n$  is the number of decisions, and  $k$  was the number of options for each decision. With  $n$  of 20 and  $k$  of 1 the time it took was approximately 10 seconds. What is the expected time required for an input of 10 decisions ( $n=10$ ) where each decision has 2 options ( $k=2$ ) in **seconds**?

The runtime in seconds can be expressed as  $cn(k^n)$  where  $c$  is some constant. We can find the  $c$  by plugging in  $n=20$  and  $k=1$  and setting the results to 10. We find that

$$\begin{aligned} 10s &= c20(1^{20}) \\ \frac{10s}{20(1)} &= c \\ c &= .5s \end{aligned}$$

To solve for the question we plug in  $n=10$  and  $k=2$ .

$$\begin{aligned} \text{Answer} &= (.5s)10(2^{10}) \\ &= 5s(1024) \\ &= 5120s \end{aligned}$$

**Grading:**

**Find  $c$ , 4 pts.**

**Plugging in 10 and 2, 4 pts.**

**Correct answer, 2 pts.**