

## 2) (5 pts) ANL (Algorithm Analysis)

An algorithm processing an array of size  $n$  runs in  $O(n\sqrt{n})$  time. For an array of size 10,000 the algorithm processes the array in 16 ms. How long would it be expected for the algorithm to take when processing an array of size 160,000? Please express your answer in *seconds*, writing out exactly three digits past the decimal.

Let the algorithm with input size  $n$  have a runtime of  $T(n) = cn\sqrt{n}$ , for some constant  $c$ . Using the given information we have:

$$\begin{aligned} T(10000) &= c(10000)\sqrt{10000} = 16ms \\ c(10000)(100) &= 16ms \\ c &= \frac{16}{10^6} ms \end{aligned}$$

Now, we must find  $T(160000)$ ;

$$T(160000) = c(160000)\sqrt{160000} = \frac{16 ms}{10^6} \times 16 \times 10^4 \times 4 \times 10^2 = 16 \times 16 \times 4ms = 1024ms$$

Converted to seconds, our final answer is **1.024 seconds.**

**Grading:** 1 pt to set up the initial equation for  $c$ , 1 pt to solve for  $c$ , 2 pts to get answer in ms, 1 pt to convert to seconds. Give partial credit for the 2 pts if the setup is correct but some algebra issue occurred. (For example, an answer of 1.536 seconds would get 4 pts probably, since a conversion was done to seconds but some arithmetic error occurred. An answer of 1536 ms would get 3 pts, 1 off for an arithmetic error and 1 off for no conversion to seconds.)