

CS/DSA ALGORITHM ANALYSIS

Homework 3, Due on Feb 07, 2019

1. Stirlings approximation for $n!$ is given by $n! \approx \sqrt{2\pi n}(\frac{n}{e})^n$. Plot the percentage error 'e' in this approximation as a function of 'n' for $2 \leq n \leq 20$ where

$$e = \frac{n! - \sqrt{2\pi n}(\frac{n}{e})^n}{n!}$$

2. $\log_e n! = \sum_{i=1}^n \log_e i \geq \int_1^n \log_e x dx$

Evaluate this integral and get a lower bound on $\log n!$

Hint: Refer to Appendix

3. Evaluate these integrals and compute their values as $n \rightarrow \infty$.

$$\sum_{i=1}^n \frac{1}{i} \approx \int_1^n \frac{dx}{x}$$

$$\sum_{i=1}^n \frac{1}{i^2} \approx \int_1^n \frac{dx}{x^2}$$

4. (a) Solve $T(n) = T(n-1) + (n-1)$ where $T(2) = 1$

(b) Solve $T(n) = T(\lfloor \frac{n}{2} \rfloor) + 1$ where $T(1) = 1$ and $n = 2^k - 1$

Note: Each question carries 10 points.