

Algorithm Analysis - CS/DSA 4413

Final Exam

Date given: April 28, 2025

Date due: May 2, 2025

1. (10 pts) Solve: $T(n) = 2T(n-1) + 3T(n-2)$ for $T(0) = 1$, $T(1) = 2$
2. (10 pts) Prove that the binary addition can be reduced to prefix computation.
3. (a) (1 pts) Define fixed length and variable length codes.
(b) (5 pts) Design Huffman code for the following.
(c) (2 pts) Compute the compression ratio.

Alphabets	a	b	c	d	e	f
Number of occurrences $\times 10^2$	20	15	13	40	29	6

- (d) (2 pts) Pick a five-letter word from this alphabet set. Encode and decode it.
4. (a) (5 pts) Define $\log^* n$, Find its value for $n = 10^{12}$. Let $n = 2^k$ and $f(n) = n/2$. Find $f^*(n)$
(b) (5 pts) Let $n = 2^{2^k}$. Solve $T(n) = T(\sqrt{n}) + 2$ where $T(2) = 1$.
5. (10 pts) Solve the six city TSP by finding the approximate tour. Describe your algorithm. Prove that the cost of the approximate tour is no more than twice the cost of optimal tour.

