Data Structures I – 150015 -5782

Formula Sheet – Midterm Quiz

Asymptotic Notation

Additional Property	Formal Definition	
$\lim_{n\to\infty} \frac{f(n)}{g(n)} < \infty$	**Definition of O :** Given two functions f(n), g(n): $\mathbf{N} \to \mathbf{R}^+$ We say that g(n) is O(f(n)) if there are positive constants n_0 and c such that **g(n)** $\leq$ **c*f(n)** for all $n \geq n_0$	O Big
$\lim_{n\to\infty} \frac{f(n)}{g(n)} > 0$	**Definition of Ω :** Given two functions f(n), g(n): $\mathbf{N} \to \mathbf{R}^+$ We say that g(n) is Ω (f(n)) if there are positive constants n_0 and c such that **g(n)** $\geq$ **c*f(n)** for all $n \geq n_0$	Ω
$\lim_{n\to\infty} \frac{f(n)}{g(n)} = c \neq 0$	**Definition of Θ :** Given two functions f(n), g(n): $\mathbf{N} \to \mathbf{R}^+$ We say that g(n) is Θ (f(n)) if there are positive constants n_0 , c_1, c_2 and c such that $c_1 f(n) \leq g(n) \leq c_2 f(n)$ for all $n \geq n_0$	Θ
$\lim_{n\to\infty} \frac{f(n)}{g(n)} = 0$	**Definition of o :** Given two functions f(n), g(n): $\mathbf{N} \to \mathbf{R}^+$ We say that g(n) is o(f(n)) if for every positive c there is positive constant n_0 such that **g(n)** < **c*f(n)** for all $n \geq n_0$	Small o
$\lim_{n\to\infty} \frac{f(n)}{g(n)} = \infty$	**Definition of ω :** Given two functions f(n), g(n): $\mathbf{N} \to \mathbf{R}^+$ We say that g(n) is ω (f(n)) if for every positive c there is positive constant n_0 such that **g(n)** > **c*f(n)** for all $n \geq n_0$	ω

Various formula

$\sum_{k=1}^{n} k = 1 + 2 + \cdots n = \frac{1}{2} n(n+1)$	$\log_b (x * y) = \log_b x + \log_b y$
$\sum_{k=0}^{n} x^k = 1 + x + x^2 + \cdots + x^n = \frac{x^{n+1} - 1}{x - 1}$ $\sum_{k=0}^{\infty} x^k = \frac{1}{1-x}$ עבור $\lvert X \rvert < 1$	$\log_b (x / y) = \log_b x - \log_b y$

$H_n = 1 + \frac{1}{2} + \frac{1}{3} + \frac{1}{4} + \cdots + \frac{1}{n} = \sum_{k=1}^{n} \frac{1}{k} = \ln n + O(1)$	$\log_b (a^n) = n \log_b a$
$\sum_{k=1}^{n} k^2 = \frac{n(n+1)(2n+1)}{6}$	$\frac{\log_c a}{\log_c b} = \log_b a$
$\lim_{x \to \infty} \frac{f(x)}{g(x)} = \lim_{x \to \infty} \frac{f'(x)}{g'(x)}$	$n^{\log_c a} = a^{\log_c n}$