Worksheet 6

CS 2210 Discrete Structures

Due 3/5 9pm. Late submissions get grade 0.

* Teams of 3-4 students (must work in group). Follow directions given during discussion.
** This page is double sided. Make sure to do both sides.

Name1: Cobin Bliss Name 2: Colin Cano

Name3: _____ Name 4: _____

Question 1: What is the big-O of $f(n) = (3n^2 + 2n^3)(1 + 5n)$ prove your answer by finding c and k.

$f(n) = 3n^2 + 17n^3 + 10n^4$

$f(n) = O(n^4)$

$3n^2 + 17n^3 + 10n^4 \leq cn^4$

$\frac{3}{n^2} + \frac{17}{n} + 10 \leq c$

$\lim_{n \to \infty} \frac{3}{n^2} + \frac{17}{n} = 0, \quad 10 \leq c$

$c = 11, \quad k = 18$

$\frac{3}{18^2} + \frac{17}{18} + 10 \leq 11.$

Question 2: What is the big-O of

a. $f(n) = \sqrt{n} + logn$ $O(\sqrt{n})$

b. $f(n) = -5n^4 + 23 - (-1)^n + 3n^7$ $O(n^7)$

c. $f(n) = nlogn + 5n^2$ $O(n^2)$

d. $f(n) = 100n^6 + 45n^4 + 2^n$ $O(n^6)$

Question 3: Suppose $x, y, z \in \mathbb{Z}$ and $x \neq 0$. Prove that if $x \nmid yz$, then $x \nmid y$ and $x \nmid z$.

Note: $\nmid$ means doesn't divide.

Contraposition: if $x \mid y$ or $x \mid z$, then $x \mid yz$.

Case1: Suppose $x \mid y$. $\exists k \in \mathbb{Z}$ s.t. $y = kx$, by def. of divisibility. $yz = kxz$. Since kxz is divisible by x, $x \mid yz$.

Case 2: Suppose $x \mid z$. $\exists m \in \mathbb{Z}$ s.t. $z = mx$, by def of divisibility. $yz = mxy$. Since mxy is divisible by x, $x \mid yz$. Th

Proven by contraposition.

Question 4: Compute:

(a) -198mod16

10

(b) -78div6

-13

(c) 243mod19

15

(d) 659div5

131

Question 5: Convert $(10111010100)_2$ to decimal. Show your work.

$2^{10}\ 2^{9}\ 2^{8}\ 2^{7}\ 2^{6}\ 2^{5}\ 2^{4}\ 2^{3}\ 2^{2}\ 2^{1}\ 2^{0}$

1 0 1 1 1 0 1 0 1 0 0

$2^{10} + 2^{8} + 2^{7} + 2^{6} + 2^{4} + 2^{2} = 1492$

Question 6: Convert $(1E27F)_{16}$ to binary, octal, decimal. Show your work.

$(1\ E\ 2\ 7\ F)_{16}$

0001 1110 0010 0111 1111

$(0001\ 1110\ 0010\ 0111\ 1111)_2$

$2^{16} + 2^{15} + 2^{14} + 2^{13} + 2^{9} + 2^{6} + 2^{5} + 2^{4} + 2^{3} + 2^{2} + 2^{1} + 2^{0} =$

$(123519)_{10}$

$123519 \div 8 = 15439$ R7

$15439 \div 8 = 1929$ R7

$1929 \div 8 = 241$ R1

$241 \div 8 = 30$ R1

$30 \div 8 = 3$ R6

$3 \div 8 = 0$ R3

$(361177)_8$

Question 7: Convert $(53481)_{10}$ to octal. Show your work.

$53481 \div 8 = 6685$ R 1

$6685 \div 8 = 835$ R 5

$835 \div 8 = 104$ R 3

$104 \div 8 = 13$ R 0

$13 \div 8 = 1$ R 5

$1 \div 8 = 0$ R 1

$(150351)_8$