CS 441: Discrete Structures for Computer Science

Spring 2020

Practice Worksheet for remaining sections

Username (abc123): _____

Section 9.1

1. (d) List the ordered pairs in the relation R from $A = \{0, 1, 2, 3, 4\}$ to $B = \{0, 1, 2, 3\}$, where $(a, b) \in R$ if and only if $a|b$. Recall that $a|b$ means that a divides b or that $b = n \times a$ for some $n \in \mathbb{Z}$ (the integers).

3. For each of these relations on the set $\{1, 2, 3, 4\}$, decide whether it is reflexive, whether it is symmetric, whether it is antisymmetric, and whether it is transitive.

   (b) $\{(1, 1), (1, 2), (2, 1), (2, 2), (3, 3), (4, 4)\}$.

   (e) $\{(1, 1), (2, 2), (3, 3), (4, 4)\}$.

7. Determine whether the relation R on the set of all integers is reflexive, symmetric, antisymmetric, and/or transitive, where $(x, y) \in R$ if and only if:

   (a) $x \neq y$.

   (b) $xy \geq 1$.

For the following problem, let:

$$R_2 = \{(a, b) \in R^2 | a \geq b\}, \text{ the greater than or equal to relation}$$
$$R_3 = \{(a, b) \in R^2 | a < b\}, \text{ the less than relation}$$
$$R_4 = \{(a, b) \in R^2 | a \leq b\}, \text{ the less than or equal to relation}$$
$$R_6 = \{(a, b) \in R^2 | a \neq b\}, \text{ the unequal to relation}$$

35. Find the following relations:

   (a) $R_2 \cup R_4$.

   (c) $R_3 \cap R_6$.

Sections 4.1 to 4.3

13. What are the quotient and remainder when:

    (a) 19 is divided by 7?

    (b) -111 is divided by 11?

15. (c) What time does a 12-hour clock read 100 hours after it reads 6:00?

29. Find a *div* m and a *mod* m when:

    (a) a = 228, m = 119.

    (c) a = -10101, m = 333.

35. Decide whether each of these integers is congruent to 5 modulo 17.

    (b) 103

    (c) -29

1. Convert the decimal expansion of each the these integers to a binary expansion.

   (a) 231

   (b) 4532

6. (a) Convert the binary expansion of $(1111\ 0111)_2$ to an octal expansion.

6. (c) Convert the binary expansion of $(111\ 0111\ 0111\ 0111)_2$ to a hexadecimal expansion.

3. Find the prime factorization of each of these integers.

   (a) 88

   (b) 126

15. Which positive integers less than 30 are relatively prime to 30?

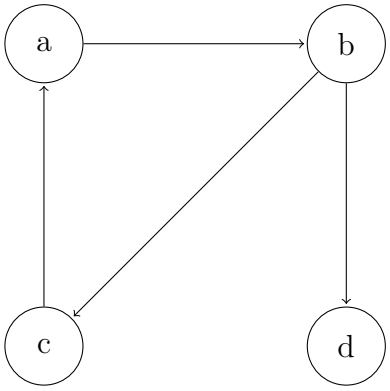
18. We call a positive integer *perfect* if it equals the sum of its positive divisors other than itself. Show that 496 is perfect.

24. Find gcd(100, 125) and lcm(100, 125) and verify that gcd(100, 125) $\times$ lcm(100, 125) $= 100 \times 125$.

33. Use the Euclidean Algorithm to find gcd(12345, 54321).

Section 10.1

3. Determine whether the graph shown has directed or undirected edges, whether it has multiple edges, and whether it has one or more loops. Use your answers to determine the type of graph. (Refer to Table 1 on page 676 of the textbook).



5. Determine whether the graph shown has directed or undirected edges, whether it has multiple edges, and whether it has one or more loops. Use your answers to determine the type of graph. (Refer to Table 1 on page 676 of the textbook).