CMSC 203 - Homework Assignment 4 - Due May 6, 2004

1. (a) Suppose I have a cooler full of cans of Coke, Pepsi, Sprite, Mountain Dew, Dr. Pepper, and Slice sodas. How many distinct ways can I line these up on a table if the cooler contains 12 of each type of soda?

(b) Suppose I have a large collection of coins consisting of Pennies, Nickels, Dimes, Quarters, Half-Dollars, and Dollars. How many ways can I select distinct combinations of 80 coins if I must have 10 of each type in each collection?
2. Consider the following sets with corresponding number of elements indicated in each region:

(a) Find $P(A)$

(b) Find $P(A \mid (B \cap C))$
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3. (a) Draw the directed graph of the relation \( R \) on \( A = \{1, 2, 3, 4, 5, 6, 7, 8\} \) defined as
\[ R = \{(a,b) \mid a,b \in A \text{ and } a \equiv b \mod 5\}. \]

(b) Find the matrix representing the relation on \( \{1, 2, 3, 4, 5\} \) given by:
\[ R = \{(1,4),(1,5),(2,1),(3,1),(3,4),(4,1),(4,4),(4,5),(5,1),(5,2),(5,4),(5,5)\} \]

(c) Find \( M_R \circ M_S \) for the relations on whose matrix representations are \( M_R = \begin{bmatrix} 1 & 0 & 0 \\ 1 & 1 & 0 \\ 0 & 1 & 1 \end{bmatrix} \) and \( M_S = \begin{bmatrix} 0 & 1 & 1 \\ 1 & 1 & 0 \\ 0 & 1 & 0 \end{bmatrix} \).
4. Consider the relation, R, on the set $A = \{a, b, c, d, e, f, g, h\}$ given by the graph:

(a) Find $[d]$

(b) Find the partition of $A$ induced by $R$
5. Let $F$ be a function on the integers given by $F(n) = n^4 + 1$.
(a) Show that the relation $R = \{(x,y) \mid x,y \text{ are integers and } F(x) = F(y)\}$ is a Reflexive, Symmetric, and Transitive relation.

(b) Describe the partition of the integers induced by $R$. 

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6. Consider the database consisting of the following Fields and Records:

<table>
<thead>
<tr>
<th>First Name</th>
<th>Last Name</th>
<th>Age</th>
<th>Phone</th>
<th>Height (in.)</th>
<th>Occupation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Michael</td>
<td>Jones</td>
<td>44</td>
<td>555-1234</td>
<td>70</td>
<td>Mechanic</td>
</tr>
<tr>
<td>Mary</td>
<td>Smith</td>
<td>31</td>
<td>555-4321</td>
<td>65</td>
<td>Office Manager</td>
</tr>
<tr>
<td>Ted</td>
<td>Green</td>
<td>22</td>
<td>555-6789</td>
<td>74</td>
<td>Student</td>
</tr>
<tr>
<td>Susan</td>
<td>Green</td>
<td>20</td>
<td>555-6789</td>
<td>69</td>
<td>Sales</td>
</tr>
<tr>
<td>William</td>
<td>Peters</td>
<td>44</td>
<td>555-9876</td>
<td>73</td>
<td>Dentist</td>
</tr>
<tr>
<td>Alan</td>
<td>Green</td>
<td>22</td>
<td>555-6789</td>
<td>70</td>
<td>Unemployed</td>
</tr>
</tbody>
</table>

(a) For this database, which Fields would serve as Primary Keys?

(b) Find $P_{1,4,5}$

(c) Find $P_{2,4}$