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Assignment 4

Question 1)

a)

i) one-to-one

f is one-to-one $\Leftrightarrow \forall x_1, x_2 \in X$ if $f(x_1) = f(x_2)$ then $x_1 = x_2$
Suppose $x_1 = x_2$ are any integer numbers such that
$4x_1 = 4x_2$
$\Rightarrow x_1 = x_2$
$\therefore$ f is one-to-one

ii) onto

Suppose $y \in R$
Show there exists an integer x such that y=4x
$y = f(x)$
$y = 4x$
$x = \frac{y}{4}$ Since y is an integer and $x = \frac{y}{4}$ is not an integer
$\therefore$ f is not onto

iii) f(x) is an one-to-one function but it is not an onto function, hence f(x) is not bijective

iv) f(x) is not an one-to-one correspondence (bijective), hence there is no inverse function for f

b) Given $f(x) = 2x + 3$ and $g(x) = -x^2 + 1$

i) $(f \circ g)(x)$

$\Rightarrow f(g(x)) = 2x + 3 = 2(-x^2 + 1) + 3$

$\Rightarrow f(g(x)) = -2x^2 + 5$

ii) $(g \circ f)(x)$

$\Rightarrow g(f(x)) = -x^2 + 1 = -(2x+3)^2 + 1$

$\Rightarrow g(f(x)) = -(4x^2 + 12x + 9) + 1$

$\Rightarrow g(f(x)) = -4x^2 - 12x - 9 + 1$

$\Rightarrow g(f(x)) = -4x^2 - 12x - 8$

c) Given $f(x) = x/(5x+1)$

Domain $x \in R$: $x \neq \frac{-1}{5}$

i) Because f(x) is assumed to be a one-to-one and onto function, hence it is a one-to-one correspondence (bijective) and there is an inverse function f(x)

ii) Given

$f(x) = \frac{x}{5x+1}$

$y = \frac{x}{5x+1}$

$y(5x+1) = x$

$5xy + y = x$

$y = x - 5xy$

$y = -x\,(5y - 1)$

$-\frac{y}{5y+1} = x$

$\Rightarrow y = -\frac{x}{5x+1}$

$\therefore f^{-1}(x) = -\frac{x}{5x+1}$

Question 2)

a) Prove $[(A - B) - (B - C)] = A - B$

Show that $[(A - B) - (B - C)] \subseteq A - B$,

Suppose $x \in [(A - B) - (B - C)]$ then $x \in (A - B)$ and $x \notin (B - C)$

$\Leftrightarrow x \in (A - B)$, $x \in A$ and $x \notin B$(1) **and** $x \notin (B - C)$, $x \notin B$ and $x \in C$(2)

$\Leftrightarrow$ From (1) and (2) we can conclude that $x \in (A - B)$

b) Prove $A - (A - B) = A \cap B$

Show that $A - (A - B) \subseteq A \cap B$ **and** $A \cap B \subseteq A - (A - B)$

<u>Case 1:</u>

Suppose $x \in A - (A - B)$ then $x \in A$ and $x \notin (A - B)$

$\Leftrightarrow x \in A$ and $x \in B$

$\Leftrightarrow x \in A$ and B

$\therefore A - (A - B) \subseteq A \cap B$

Case 2:

Suppose $x \in A \cap B$ then $x \in A$ and $x \in B$

$\Leftrightarrow x \in A$ and $x \notin (A - B)$

$\Leftrightarrow x \in A - (A - B)$

$\therefore A \cap B \subseteq A - (A - B)$

Let X = {1,3,5,7,9}, Y= {3,6,9,11,12}, W= {1,2,3,4,5,6,7,8,9,10} and U = {1,2,3,4,5,6,7,8,9,10,11,12,13,14,15}

i) $X - Y \cap W^C = X - \varnothing = X = \{1,3,5,7,9\}$

ii) $Y \cup W = W = \{1,2,3,4,5,6,7,8,9,10,11,12\}$

iii) $W^C = U - W = \{11,12,13,14,15\}$

iv) $X \cap W = \{1,3,5,7,9\}$

Question 3)

a) How many vacant 2 bedroom suites are being managed?

```
MySQL [cmpt260_nlt895]> SELECT COUNT(*)
    -> FROM SUITES
    -> WHERE bedrooms = 2 AND occupied = false;
+----------+
| COUNT(*) |
+----------+
|        6 |
+----------+
1 row in set (0.00 sec)

MySQL [cmpt260_nlt895]>
```

b) Give the addresses of buildings in zone 1 that do not have any suites renting for more than $1000 per month.

```
MySQL [cmpt260_nlt895]> SELECT DISTINCT(b.address) AS "Addresses of buildings"
       -> FROM APT_BUILDING b, SUITES s
       -> WHERE b.building_id = s.building_id AND b.zone = 1 AND s.rent <= 1000;
+------------------------+
| Addresses of buildings |
+------------------------+
| 100 sutherland ave.    |
| 6 sutherland St.       |
|      4 sutherland place|
| 2 sutherland place     |
+------------------------+
4 rows in set (0.00 sec)

MySQL [cmpt260_nlt895]>
```

c) Give the names of buildings with no vacant suites.

```
MySQL [cmpt260_nlt895]> SELECT DISTINCT(b.name)
       -> FROM APT_BUILDING b, SUITES s
       -> WHERE b.building_id = s.building_id AND s.occupied = true;
+------------------+
| name             |
+------------------+
| smug towers      |
| bigshot towers   |
| midrise 2.0      |
| sutherland tower |
| tiny apt         |
| lowrise manor    |
| slow towers      |
+------------------+
7 rows in set (0.00 sec)

MySQL [cmpt260_nlt895]>
```

d) Give the names of the tenants that are renting in the building called sutherland tower

```
MySQL [cmpt260_nlt895]> SELECT t.name
    -> FROM APT_BUILDING b, SUITES s, TENANT t
    -> WHERE b.building_id = s.building_id AND s.suite_id = t.suite_id AND b.name =
'sutherland tower';
+-------+
| name  |
+-------+
| Jaabb |
| Jaadd |
| Keebb |
+-------+
3 rows in set (0.00 sec)

MySQL [cmpt260_nlt895]>
```