Quiz 1A (19 Oct, 11.00 - 12.00)
Propositional & Predicate Logic,
Set, Function & Relation

Name_____

ID_____No._____

ONLY THE ANSWERS IN THE ANSWER SHEET WILL BE GRADED.

Part 1: Propositional & Predicate Logic (8 Points)

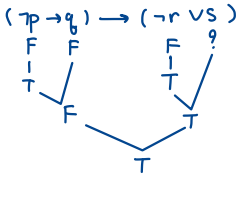
1. Are these sentences propositions? (Yes or No)
   - 1.1. Do you wanna build a snowman — No: เป็นประโยคคำถาม
   - 1.2. The sun is bigger than the moon — Yes
   - 1.3. x is greater than y — No: ไม่รู้ว่า x, y คืออะไร
   - 1.4. Every integer x, x = sqrt(x) + y + 1 — No: ไม่รู้ว่า y คืออะไร
   - 1.5. Some DS-TAs think TA Potter is handsome — Yes

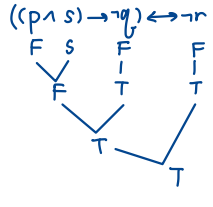
2. Given proposition below
   "Roses are red and Violets are red, whenever you like red color"
   Let p: Roses are red, q: Violet are red and r: you like red color
   Choose the correct answer for each question.
   - 2.1. PROPOSITION: $p \to q$
     a) $(p \wedge q) \to r$ ~~b) $r \to (p \wedge q)$~~
   - 2.2. CONVERSE: $q \to p$
     ~~a) $(p \wedge q) \to r$~~ b) $r \to (p \wedge q)$
   - 2.3. CONTRAPOSITIVE: $\neg q \to \neg p$
     ~~a) $\neg(p \wedge q) \to \neg r$~~ b) $\neg r \to \neg(p \wedge q)$
   - 2.4. INVERSE: $\neg p \to \neg q$
     a) $\neg(p \wedge q) \to \neg r$ ~~b) $\neg r \to \neg(p \wedge q)$~~
   - 2.5. NEGATION:
     a) $\neg((p \wedge q) \to r)$ ~~b) $\neg(r \to (p \wedge q))$~~

3. Given the truth table below
   - 3.1. The error occurs in row 2 column 5.
   - 3.2. Determine the truth values of W, X, Y and Z.
     (***according to the correct truth table)

	1	2	3	4	5	6	7
	p	q	¬p	q→¬p	(q→¬p) ∧ q	¬q	((q→¬p) ∧ q) ↔ ¬q
1	T	T	F	F	F	F	**W** T
2	T	F	F	T	~~T~~ F	T	**X** F
3	F	T	T	T	T	F	**Y** F
4	F	F	T	T	F	T	**Z** F

4. Let p, q, r and s be the propositions. The truth values of p, q and r are F, F and F, respectively. Determine the truth value of each of these propositions.
   Choice: a) T b)F c) Depends on s
   - 4.1. $(\neg p \to q) \to (\neg r \vee s)$ — a) T
   - 4.2. $((p \wedge s) \to \neg q) \leftrightarrow \neg r$ — a) T





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5. Determine whether these statements

a) Tautology b) Contradiction c) Contingency.

5.1. $(p \land (p \rightarrow q)) \rightarrow q$ (Note: This is Rule of inference ;") Ans: a)

5.2. $(p \lor q) \rightarrow \neg p$ Ans: c)

6. Determine whether these statements are consistent.(Yes or No)

a) When you like chocolate croissants and buy strawberry croissants, you are not happy.

b) If you buy strawberry croissants, you do not like chocolate croissants.

c) You like chocolate croissants or you are happy.

Ans: Yes

7. Determine the truth value of the following statements.

7.1. $(p \lor q) \rightarrow p \equiv (p \land q) \rightarrow (q \rightarrow p)$ Ans: F

7.2. $\exists x \forall y(x^2 - y^2 = 0)$ when $x, y \in R^-$ Ans: F

7.3. If $\forall xP(x)$ is true when $x \in I^+$ then $\exists xP(x)$ is always true when $x \in R$ Ans: T

7.4. $\forall xP(x)$ is true when $x \in \emptyset$ Ans: T

8. For the arguments,

Premise:

$\forall x(P(x) \land Q(x))$

$\forall x(R(x) \rightarrow \neg S(x))$

$\forall x(\neg Q(x) \lor S(x))$

$\exists x \neg P(x)$

Conclusion: $\exists x \neg R(x)$

The steps:

1.	$\forall x(P(x) \land Q(x))$	– Premise
2.	$P(c) \land Q(c)$	– Universal Instantiation using (1)
3.	$Q(c)$	– Disjunctive syllogism using (2)
4.	$\forall x(\neg Q(x) \lor S(x))$	– Premise
5.	$\neg Q(c) \lor S(c)$ for some elements c	– Existential Instantiation (4)
6.	$S(c)$	– Disjunctive Syllogism using _(a)_ and _(b)_
7.	$\forall x(R(x) \rightarrow \neg S(x))$	– Premise
8.	$R(c) \rightarrow \neg S(c)$	– Universal Instantiation (7)
9.	$\neg R(c)$	– Modus tollens using (6) and (8)
10.	$\exists x \neg R(x)$	– Existential Generalization using (9)

8.1. Identify steps (a) and (b)

a = 3 b = 5

8.2. There is an error in step 3.(Only ONE error)

A

Part 2: Set (6 Points)

1. Which of the following statements is correct?
   a. $\{a, b, c, \emptyset\} \subseteq \{a, b, c, c\}$
   b. If A ⊂ B and A ⊂ C, then A ⊂ B ∩ C
   c. If A ⊆ B and B ⊆ C, then A ⊆ C
   d. {∅} ⊂ {{∅},1}

a) $\emptyset$ is not in $\{a,b,c,c\}$ ∴ The statement is incorrect

b) Let $A=\{1\}$, $B=\{1,2\}$, $C=\{1,3\}$ which satisfy conditions
$A \subset B$ and $A \subset C$
$B \cap C = \{1\}$ which results in $B \cap C = A$
∴ A is not a proper subset of $B \cap C$. The statement is incorrect

c) $A \subseteq B$ means all members of A must exist in B
$B \subseteq C$ "  C
Therefore all members of A must exist in C as well ∴ Correct

d) $\emptyset \notin \{\{\emptyset\},1\}$ ∴ $\{\emptyset\} \notin \{\{\emptyset\},1\}$

2. Which of the following statements is correct?
   a. $\{\emptyset\} \in P(\{a, b, c, c\})$
   b. If A ∈ B and B ∈ C, then A ∈ C.
   c. A × B × C = (A × B) × C where A,B and C are sets.
   d. Let A = {x | x is odd and |x| < 7 } There are 64 possible subsets of A

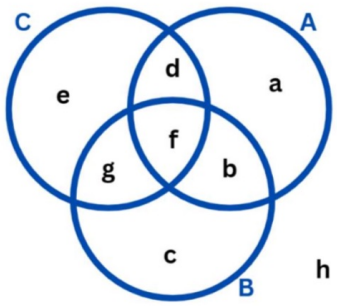
a) $\emptyset \notin \{a,b,c\}$
$\{\emptyset\} \notin \{a,b,c\}$
$\{\emptyset\} \notin P(\{a,b,c\})$ ∴ The statement is incorrect

b) Let $A=1$, $B=\{1\}$ and $C=\{\{1\}\}$ # counterexample
$A \notin C$ ∴ Incorrect

c) Consider $A=\{0\}$, $B=\{1\}$, $C=\{2\}$
$A \times B \times C = \{(0,1,2)\}$
while $(A \times B) \times C = \{(0,1),2\}$ ∴ Incorrect

d) $A = \{-5,-3,-1,1,3,5\}$
$|P(A)|$ = Number of possible subsets of A
$= 2^{|A|} = 2^6 = 64$ ∴ Correct

3. Which combination of the sets A,B,C will result in the given area



3.1) a,b and d → f
a) A' ∩ (B' ∪ C') → a, b, d
b) A ∩ (B' ∪ C')
c) C' ∩ (B' ∪ A') → a, c, h

3.2) e and g
a) B' ∪ C'
b) (A ∪ C')'
c) (C' ∩ A')'

= B ∩ C → g, f
= A' ∩ C → e, g
= C ∪ A → e, d, a, g, f, b

4. Let C = {{∅},∅,1,2,{{∅}}}
A = {{1,2},{1}}
Find |P(C) U C| + |P(A - C)| - | P(C) - A|

$|P(C)| = 2^{|C|} = 2^{5} = 32$

- Consider $C = \{\{\emptyset\},\emptyset,1,2,\{\{\emptyset\}\}\}$

$P(C) \cap C = \{\{\emptyset\},\{\{\emptyset\}\},\emptyset\}$ since $\emptyset \subset C \rightarrow \emptyset \in P(C)$ and $\emptyset \in C$

$|P(C) \cup C| = |P(C)| + |C| - |P(C) \cap C|$

$= 32 + 5 - 3 = 34$

- $|P(A-C)| = 2^{|A-C|} = 2^{|2|} = 4$ since $A \cap C = \emptyset$

- $|P(C)-A| = |P(C)| - |P(C) \cap A| = 32 - 2 = 30$ since both $\{1,2\}$ and $\{1\}$ are subsets of C, $\{1,2\}$ and $\{1\}$ must exist in P(C)

$\therefore |P(C) \cup C| + |P(A-C)| + |P(C)-A| = 34 + 4 - 30 = 8$ //

5. Let U = {1,2,3,...,17,18}
A = {x | $x^2 \notin U$}
B = {x | $2x \notin U \wedge x/3 \notin A$}
C = {x | $x \notin A \wedge 4x \in B$}
Find |A ∩ B| + |B U C|

Ans = 16

Same as Q12.1b

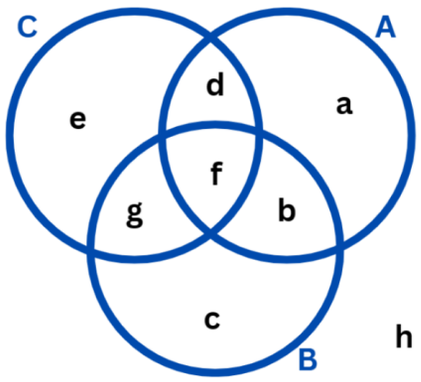
6. Consider set A,B, and C where |A| = 7, |B| = 10 , |C ∩ B| = 3 , |A ∪ B| = 13 , |C ∩ A ∩ B| = 2 , |A-C| = 5
6.1 Find |(A ∪ B) - C |
6.2 Find minimum cardinality of C

6.1 → 10
6.2 → 3

d. $\{\varnothing\} \subset \{\{\varnothing\},1\}$

2. Which of the following statements is correct?
   a. $\{\emptyset\} \in P(\{a,b,c,c\})$
   b. If A ∈ B and B ∈ C, then A ∈ C.
   c. A × B × C = (A × B) × C where A,B and C are sets.
   d. Let A = {x | x is odd and |x| < 7 } There are 64 possible subsets of A

3. Which combination of the sets A,B,C will result in the given area



3.1) a,b and d
a) A' ∩ (B' ∪ C')
b) A ∩ (B' ∪ C')
c) C' ∩ (B' ∪ A')

3.2) e and g
a) B' ∪ C'
b) (A ∪ C')'
c) (C' ∩ A')'

4. Let C = {{∅},∅,1,2,{{∅}}}
   A = {{1,2},{1}}
   Find |P(C) U C| + |P(A - C)| - | P(C) - A|

5. Let U = {1,2,3,...,17,18}
   A = {x | x ² ∉ U}
   B = {x | 2x ∉ U ∧ x/3 ∉ A}
   C = {x | x ∉ A ∧ 4x ∈ B}
   Find |A ∩ B| + |B U C|

6. Consider set A,B, and C where |A| = 7, |B| = 10 , |C ∩ B| = 3 , |A ∪ B| = 13 , |C ∩ A ∩ B| = 2 , |A-C| = 5
   6.1 Find |(A ∪ B) - C |
   6.2 Find minimum cardinality of C

Part 3: Function & Relation (6 Points)

1. Consider the function $f(x) = \frac{2}{\sqrt{x+1}}$ from $D \rightarrow R$. Determine the values of a, b for the domain(D) and range of the function. $\sqrt{x+1} > 0$ | when $x \to \infty$ $a = -1$
   $x > -1$ $f(x) \to 0$ $b = 0$

   $D =$ _____(a, ∞)_____ $range =$ _____(b, ∞)_____

2. Let $f(x) = 3x + 5$.Determine the value of

   $f(1.5) = 9.5$ | $f(-2.5) = -2.5$

   $\lfloor f(1.5) \rfloor = 9$ | $\lceil f(-2.5) \rceil = -2$

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2.1) $\lfloor f(1.5) \rfloor$ 2.2) $\lceil f(-2.5) \rceil$

3. Classify each function (✓) $f: \mathbb{Z} \to \mathbb{Z}$ by their types of correspondences **in the answer sheet.**

Function	One-to-one, but not onto	Onto, but not One-to-one	One-to-on, And onto	Neither Onto, nor One-to-one
3.1) $f(x) = x^2 + 1$				✓
3.2) $f(x) = x^3$	✓			
3.3) $f(x) = x(x+1)(x-1)$				✓
3.4) $f(x) = 3x + 5$	✓			
3.5) $f(x) = 42$				✓

4. Let $f(x) = 2x^2$ and $g(x) = \sqrt{x+3}$ is the function from $\mathbb{Z}^+ \to R^+$. Find the value of $g^{-1}(f^{-1}(8))$

f(x): $x = 2y^2$, $y = \sqrt{\frac{x}{2}}$, $f^{-1}(x) = \sqrt{\frac{x}{2}}$

g(x): $x = \sqrt{y+3}$, $y = x^2 - 3$, $g^{-1}(x) = x^2 - 3$

$f^{-1}(8) = 2$

$g^{-1}(f^{-1}(8)) = g^{-1}(2)$

$= 1$ ✓

5. Consider set A of 3 elements. How many relations R on set A, which are symmetric?

Let $A = \{a, b, c\}$

ตัวรอง \ ตัวแรก	a	b	c
a		A	B
b	A		C
c	B	C	

→ ถ้ามี (a,b) ต้องมี (b,a) 1
มี (a,c) ต้องมี (c,a) 2
มี (b,c) ต้องมี (c,b) 3
(a,a) 4 (b,b) 5 (c,c) 6 มี/ไม่มีก็ได้

$= 2^6$ relation ✓

6. For each of these relations on the set {1,2,3,4}, decide (✓) whether it is reflexive, symmetric, antisymmetric, or transitive **in the answer sheet.**

Relation	Reflexive	Symmetric	Antisymmetric	Transitive
6.1) {(1,3),(2,2),(3,1),(4,4)}		✓		
6.2) {1,2,3} x {1,2,3}		✓		✓
6.3) {(x,y) | x = y}	✓	✓	✓	✓
6.4) {(1,3),(2,3),(4,1),(4,4)}			✓	

Quiz 1B (19 Oct, 11.00 - 12.00)
Propositional & Predicate Logic,
Set, Function & Relation

Name_____
ID_____No._____

ONLY THE ANSWERS IN THE ANSWER SHEET WILL BE GRADED.

Part 1: Propositional & Predicate Logic (8 Points)

1. Are these sentences propositions? (Yes or No)
   - 1.1. The moon is bigger than the sun
   - 1.2. Do you wanna build a sand castle
   - 1.3. y is less than x
   - 1.4. Some integer x, x = sqrt(x+1) + y + 4
   - 1.5. Every DS-TAs think TA Fah is kind

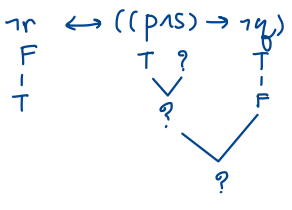
Yes
No: เป็นประโยคคำถาม
No: ไม่รู้ว่า x, y คืออะไร
No: ไม่รู้ว่า y คืออะไร
Yes

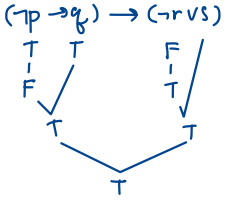
2. Given proposition below
   "Jasmines are blue and Sunflower are blue, whenever you like blue color"
   Let p: Jasmines are blue, q: Sunflower are blue and r: you like blue color
   Choose the correct answer for each question.
   - 2.1. PROPOSITION : $p \to q$
     a) $(p \wedge q) \to r$ ~~b) $r \to (p \wedge q)$~~
   - 2.2. CONVERSE: $q \to p$
     ~~a) $(p \wedge q) \to r$~~ b) $r \to (p \wedge q)$
   - 2.3. CONTRAPOSITIVE: $\neg q \to \neg p$
     ~~a) $\neg(p \wedge q) \to \neg r$~~ b) $\neg r \to \neg(p \wedge q)$
   - 2.4. INVERSE: $\neg p \to \neg q$
     a) $\neg(p \wedge q) \to \neg r$ ~~b) $\neg r \to \neg(p \wedge q)$~~
   - 2.5. NEGATION:
     a) $\neg((p \wedge q) \to r)$ ~~b) $\neg(r \to (p \wedge q))$~~

3. Given the truth table below
   - 3.1. The error occurs in row 2 column 5
   - 3.2. Determine the truth values of W, X, Y and Z.
     (***according to the correct truth table)

	1	2	3	4	5	6	7
	p	q	¬p	q→¬p	(q→¬p) ∧ q	¬q	((q→¬p) ∧ q) ↔ ¬q
1	T	T	F	F	F	F	**W** T
2	T	F	F	T	~~T~~ F	T	**X** F
3	F	T	T	T	T	F	**Y** F
4	F	F	T	T	F	T	**Z** F

4. Let p, q, r and s be the propositions. The truth values of p, q and r are T, T and F, respectively. Determine the truth value of each of these propositions.
   Choice: a) T b)F c) Depends on s
   - 4.1. $\neg r \leftrightarrow ((p \wedge s) \to \neg q)$ — c) s
   - 4.2. $(\neg p \to q) \to (\neg r \vee s)$ — a) T





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5. Determine whether these statements are
   a) Tautology b) Contradiction c) Contingency.

   5.1. $(p \land (p \rightarrow q)) \rightarrow q$ (Note: This is Rule of inference ;") a) _____

   5.2. $(p \lor q) \rightarrow \neg p$ c) _____

6. Determine whether these statements are consistent.(Yes or No)
   a) When you like chocolate croissants and buy strawberry croissants, you are not happy.
   b) You like chocolate croissants or you are happy.
   c) If you buy strawberry croissants, you do not like chocolate croissants.
   Ans: _____

7. Determine the truth value of the following statements.

   7.1. $(p \lor q) \rightarrow p \equiv (p \land q) \rightarrow (q \rightarrow p)$ _____

   7.2. $\exists x \forall y(x^2 - y^2 = 0)$ when $x, y \in R^-$ _____

   7.3. $\forall x P(x)$ is true when $x \in \emptyset$ _____

   7.4. If $\forall x P(x)$ is true when $x \in I^+$ then $\exists x P(x)$ is always true when $x \in R$ _____

8. For the arguments,
   Premise:
   $\forall x(P(x) \land Q(x))$
   $\forall x(R(x) \rightarrow \neg S(x))$
   $\forall x(\neg Q(x) \lor S(x))$
   $\exists x \neg P(x)$
   Conclusion: $\exists x \neg R(x)$
   The steps:

1.	$\forall x(P(x) \land Q(x))$	– Premise
2.	$P(c) \land Q(c)$	– Universal Instantiation using (1)
3.	$Q(c)$	– Disjunctive syllogism using (2)
4.	$\forall x(\neg Q(x) \lor S(x))$	– Premise
5.	$\neg Q(c) \lor S(c)$ for some elements c	– Existential Instantiation (4)
6.	$S(c)$	– Disjunctive Syllogism using (3) and (5)
7.	$\forall x(R(x) \rightarrow \neg S(x))$	– Premise
8.	$R(c) \rightarrow \neg S(c)$	– Universal Instantiation (7)
9.	$\neg R(c)$	– Modus Tollens using __(a)__ and __(b)__
10.	$\exists x \neg R(x)$	– Existential Generalization using (9)

   8.1. Identify steps (a) and (b)
   a = _____ b = _____

   8.2. There is an error in step _____.(Only ONE error)

Part 2: Set (6 Points)

1. Which of the following statements is correct?
   a. Let A = {x | x is odd and |x| < 7 } There are 32 possible subsets of A
   b. A × B × C = (A × B) × C where A,B and C are sets.
   c. $\{\emptyset\} \subset P(\{a, b, c, c\})$
   d. If A ∈ B and B ∈ C, then A ∈ C.

a) $A = \{-5, -3, -1, 1, 3, 5\}$

$|P(A)|$ = Number of possible subsets of A

$= 2^{|A|} = 2^6 = 64$ ∴ Incorrect

b) Consider $A = \{0\}, B = \{1\}, C = \{2\}$

$A \times B \times C = \{(0,1,2)\}$

while $(A \times B) \times C = \{(0,1),2\}$ ∴ Incorrect

c) Since $\emptyset$ is subset of any sets

$\emptyset \in P(A)$ for all set A

Therefore $\{\emptyset\} \subset P(A)$ ∴ Correct

d) Let $A = 1$, $B = \{1\}$ and $C = \{\{1\}\}$ # counterexample

$A \notin C$ ∴ Incorrect

2. Which of the following statements is correct?
   a. $\{a, b, c\} \subset \{a, b, c, c\}$
   b. If A ⊆ B and B ⊆ C, then A ⊆ C
   c. If A ⊂ B and A ⊂ C, then A ⊂ B ∩ C
   d. {∅} ⊂ {{∅},1}

a) $\{a,b,c\} = \{a,b,c,c\}$

$\{a,b,c\} \subseteq \{a,b,c\}$

but $\{a,b,c\}$ is not a "proper" ($\subset$) subset of $\{a,b,c\}$

$A \subset B$ "A is a proper subset of B" when $A \subseteq B$ but $A \neq B$

∴ Incorrect

b) $A \subseteq B$ means all members of A must exist in B

$B \subseteq C$ "

Therefore all members of A must exist in C as well ∴ Correct

c) Let $A = \{1\}$, $B = \{1,2\}$, $C = \{1,3\}$ which satisfy conditions

$A \subset B$ and $A \subset C$

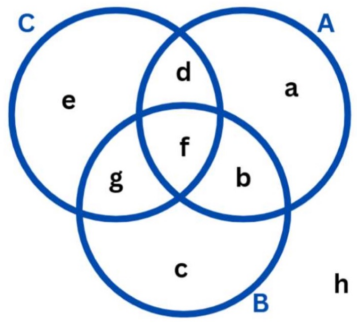
$B \cap C = \{1\}$ which results in $B \cap C = A$

∴ A is not a proper subset of $B \cap C$. The statement is incorrect

d) Since $\emptyset \notin \{\{\emptyset\}, 1\}$

∴ $\emptyset \subset \{\{\emptyset\}, 1\}$ is incorrect

3. Which combination of the sets A,B,C will result in the given area



5.1) a,b and d
a) $A \cap (B' \cup C')$ → a,b,d
b) $C' \cap (B \cap A)'$ → a,c,h
c) $A' \cap (B' \cup C')$ → f

5.2) e and g
a) $B' \cup C' = B \cap C$ → g,f
b) $(A \cup C')' = A' \cap C$ → e,g
c) $(C' \cap A')' = C \cup A$ → e,d,a,g,f,b

4. Let C = {{∅},∅,4,2,{{∅}}}
A = {{4,2},{4}}
Find |P(C) U C| + |P(A - C)| + | P(C) - A|

$|P(C)| = 2^{|C|} = 2^{|5|} = 32$

- Consider $C = \{\{\emptyset\},\emptyset,4,2,\{\{\emptyset\}\}\}$

$P(C) \cap C = \{\{\emptyset\},\{\{\emptyset\}\},\emptyset\}$ since $\emptyset \subset C \rightarrow \emptyset \in P(C)$ and $\emptyset \in C$

$|P(C) \cup C| = |P(C)| + |C| - |P(C) \cap C|$
$= 32 + 5 - 3 = 34$

- $|P(A-C)| = 2^{|A-C|} = 2^{|2|} = 4$ since $A \cap C = \emptyset$

- $|P(C)-A| = |P(C)| - |P(C) \cap A| = 32 - 2 = 30$ since both {4,2} and {4} are subsets of C, {4,2} and {4} must exist in P(C)

$\therefore |P(C) \cup C| + |P(A-C)| + |P(C)-A| = 34 + 4 + 30 = 68$ //

5. Let U = {1,2,3,...,17,18}
A = {x | $x^2 \notin U$}
B = {x | $2x \notin U \wedge x/3 \notin A$}
C = {x | $x \notin A \wedge 4x \in B$}
Find |A ∩ B| + |B U C|

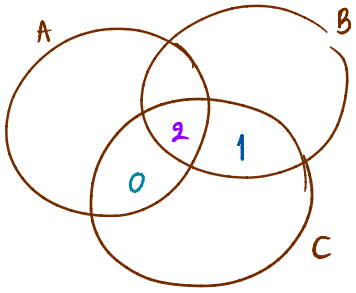
$A = \{5,6,7 \ldots 17,18\}$

$B = \{10,11,12 \ldots 17,18\} - \{x \mid x/3 \in A\} = \{10,11,\ldots 17,18\} - \{15,18\}$

$C = \{3,4\}$

$|A \cap B| + |B \cup C| = 7 + 9 = 16$ //

6. Consider set A,B, and C where |A| = 7, |B| = 10 , |C ∩ B| = 3 , |A ∪ B| = 13 , |C ∩ A ∩ B| = 2 , |A-C| = 5
6.1 Find minimum cardinality of C
6.2 Find |(A ∪ B) - C |



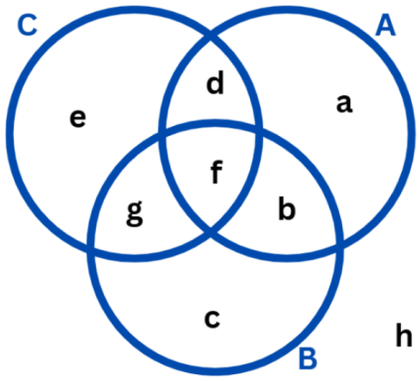
① from $|A \cap B \cap C| = 2$
② From $|C \cap B| = 3$
$\therefore |(C \cap B) - A| = 1$
③ From $|A-C| = 5$ and $|A| = 7$ $\therefore (A \cap C) - B = \emptyset$
No more information about C $\therefore |C| \geq 2+1$ ③ // 6.1

$|(A \cup B) - C| = |A \cup B| - |(A \cup B) \cap C|$
$= 13 - 3 = 10$ // 6.2

d. If A ∈ B and B ∈ C, then A ∈ C.

2. Which of the following statements is correct?
   a. $\{a, b, c\} \subset \{a, b, c, c\}$
   b. If A ⊆ B and B ⊆ C, then A ⊆ C
   c. If A ⊂ B and A ⊂ C, then A ⊂ B ∩ C
   d. {∅} ⊂ {{∅},1}

3. Which combination of the sets A,B,C will result in the given area



5.1) a,b and d
a) A ∩ (B' ∪ C')
b) C' ∩ (B ∩ A)'
c) A' ∩ (B' ∪ C')

5.2) e and g
a) B' ∪ C'
b) (A ∪ C')'
c) (C' ∩ A')'

4. Let C = {{∅},∅,4,2,{{∅}}}
   A = {{4,2},{4}}
   Find |P(C) U C| + |P(A - C)| + | P(C) - A|

5. Let U = {1,2,3,...,17,18}
   A = {x | x ² ∉ U}
   B = {x | 2x ∉ U ∧ x/3 ∉ A}
   C = {x | x ∉ A ∧ 4x ∈ B}
   Find |A ∩ B| + |B U C|

6. Consider set A,B, and C where |A| = 7, |B| = 10 , |C ∩ B| = 3 , |A ∪ B| = 13 , |C ∩ A ∩ B| = 2 , |A-C| = 5
   6.1 Find minimum cardinality of C
   6.2 Find |(A ∪ B) - C |

Part 3: Function & Relation (6 Points)

1. Consider the function $f(x) = \frac{3}{\sqrt{x-1}}$ from $D \rightarrow R$. Determine the values of a, b for the domain(D) and range of the function. $x-1>0$ $x>1$ | เมื่อ $x \to \infty$ $f(x) \to 0$ $a=1$ $b=0$

$D =$ _____(a, ∞)_____ $range =$ _____(b, ∞)_____

2. Let $f(x) = 1.3x + 2$. Determine the value of

$f(1) = 3.3$ $f(-3) = -1.9$

$\lfloor f(2) \rfloor = 3$ $\lceil f(-3) \rceil = -1$

Quiz 1B (19 Oct, 11.00 - 12.00)
Propositional & Predicate Logic,
Set, Function & Relation

Name_____

ID_____No._____

2.1) $\lfloor f(1) \rfloor$ 2.2) $\lceil f(-3) \rceil$

3. Classify each function (✓) f:ℤ->ℤ by their types of correspondences **in the answer sheet.**

Function	One-to-one, but not onto	Onto, but not One-to-one	One-to-on, And onto	Neither Onto, nor One-to-one
3.1) $f(x) = 99$				✓
3.2) $f(x) = 2x^2 + 3$				✓
3.3) $f(x) = 2x + 8$	✓			
3.4) $f(x) = x(x+2)(x-2)$				✓
3.5) $f(x) = 2x^3$	✓			

4. Let $f(x) = \frac{x^2}{2}$ and $g(x) = \sqrt{2x+4}$ is the function from $\mathbb{Z}^+ \to R^+$. Find the value of $g^{-1}(f^{-1}(8))$

f(x): $x = \frac{y^2}{2}$, $y = \sqrt{2x}$, $f^{-1}(x) = \sqrt{2x}$

g(x): $x = \sqrt{2y+4}$, $y = \frac{x^2-4}{2}$, $g^{-1}(x) = \frac{x^2-4}{2}$

$f^{-1}(8) = 4$

$g^{-1}(f^{-1}(8)) = g^{-1}(4)$

$= 6$ ★

5. Consider set A of 3 elements. How many relations R on set A, which are symmetric?

Let $A = \{a, b, c\}$

ตัวแรก \ ตัวหลัง	a	b	c
a		A	B
b	A		C
c	B	C	

→ ถ้ามี (a,b) ต้องมี (b,a) 1

มี (a,c) ต้องมี (c,a) 2

มี (b,c) ต้องมี (c,b) 3

(a,a) 4 (b,b) 5 (c,c) 6 มี/ไม่มีก็ได้

$= 2^6$ relation ★

6. For each of these relations on the set $\{1, 2, 3, 4\}$, decide (✓) whether it is reflexive, symmetric, antisymmetric, or transitive **in the answer sheet.**

Relation	Reflexive	Symmetric	Antisymmetric	Transitive
6.1) {(x,y) | x = y}	✓	✓	✓	✓
6.2) {(1,3),(2,2),(3,1),(4,4)}		✓		
6.3) {(1,3),(2,3),(4,1),(4,4)}			✓	
6.4) {1,2,3} x {1,2,3}		✓		✓