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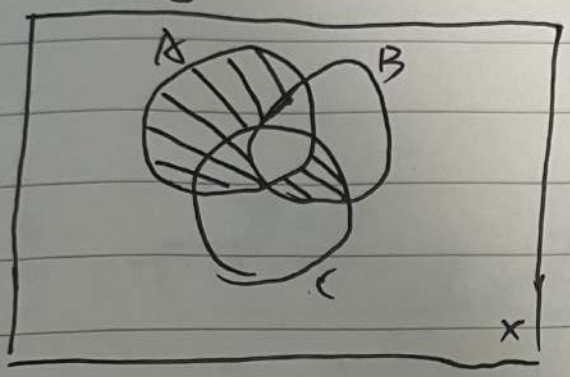
~~Math~~ Question 1 [Numbers and Set Theory]

(a)

i $(A \setminus B) \cup ((B \cap C) \setminus A)$

Venn diagram



ii $(A \setminus B) \cup ((B \cap C) \setminus A)$

$\therefore$ use $\cup \cap -$

$(A \cap \bar{B}) \cup (B \cap C) \cap \bar{A})$

iii $[x \in \mathbb{Z} \; x^2 \leq 40] = D$

D (0, 1, 2, 3, 4, 5, 6, -1, -2, -3, -4, -5, -6)

$[x \in \mathbb{Z} \; y \in \mathbb{Z} \; 3y = x]$

E (0, 3, 6, -3, -6)

$\therefore$

$D \cap E$ (0, 3, 6, -3, -6)

D (0, 1, 2, 3, 4, 5, 6, -1, -2, -3, -4, -5, -6)

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(b) a

i Z_6 doesn't satisfy the inverse multiplicative rule, Because

Z_6

y \ x	0	1	2	3	4	5
0	0	0	0	0	0	0
1	0	1	2	3	4	5
2	0	2	4	0	2	4
3	0	3	0	3	0	3
4	0	4	2	0	4	2
5	0	5	4	3	2	1

ii

```
X ← 0
S ← 0
while (X < n) {
    X ← X+1
    S ← S+2X-1 }
return S
```

If P is true before the loop strat. and true after loop iterates

① check basis statemant

$P(0) = X=0,\ S=0,\ S=X^2$

$P(1) = X=1,\ S=1,\ S=X^2$ ....

assume $P(k)$ is true, $P(k+1)$ $X = k+1$ $S =$

$S: 0 + 2(1) - 1 + 2(2) - 1 + 2(3) - 1$

$\cdots + 2(k) - 1 + (2k+1)$

$= k^2 + 2k + 1$

$\downarrow$ $(K+1)^2$

If $P(k)$ is true

$P(k+1)$ is also true so $S = X^2$

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In JAVA

(C) The cardinality of this set is countable, and the set is countable with both the list set and number stream that we defined, arrays are the more efficient, but it's capacity is fixed and cannot be change dynamically the set list can make capacity can grow dynamically, But Sacrifice efficiency

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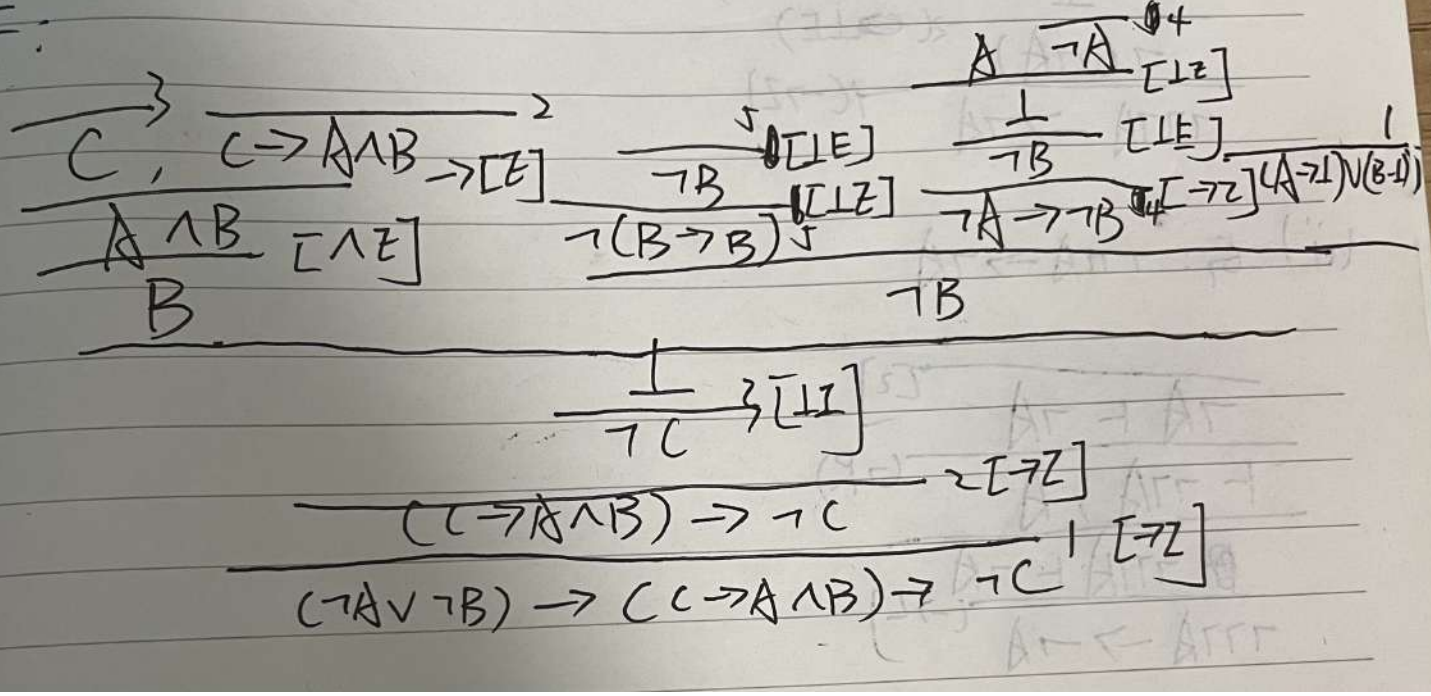
Question 2 [Propositional Logic]

(a)

$F : (\neg A \vee \neg B) \to (C \to A \wedge B) \to \neg C$

F:



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(b)

(i) $G: \neg\neg\neg A \to \neg A$

$$\dfrac{\dfrac{\dfrac{\dfrac{\neg\neg\neg A \quad \neg\neg A}{\bot}(\neg E)}{\neg(\neg\neg A)}(\bot E)}{\neg\neg\neg A \to \neg A}(\neg\to)}{}$$

(ii) $G: \neg\neg\neg A \to \neg A$

$$\dfrac{\dfrac{\dfrac{\dfrac{}{\neg A \vdash \neg A}[Z]}{\vdash \neg\neg A, A}(\neg R)}{\neg\neg A \vdash \neg A}(\to L)}{\neg\neg\neg A \to \neg A}$$

(c)

$H: (\neg P \to Q \wedge R) \to P \vee R$

$$\dfrac{\dfrac{\dfrac{\dfrac{\dfrac{\dfrac{\dfrac{}{P, R \vdash P}[Zd] \quad \dfrac{}{\neg P, Q, R \vdash R}[Zd]}{P, R \vdash \neg P \to Q \wedge R}[\wedge R]}{P \vdash R \vdash \neg P \to Q \wedge R}[R]}{P \vdash R, \neg P \to Q \wedge R}[R]}{\vdash P, R, (\neg P \to Q \wedge R)}[L]}{(\neg P \to Q \wedge R) \vdash P, R}[\vee R]}{\vdash (\neg P \to Q \wedge R) \Rightarrow P \vee R}$$

$$(\neg P \to Q \wedge R) \to P \vee R$$