1. (a) $(p \to (q \to r)) \to ((p \to \sim r) \to (p \to \sim q))$

$\sim(\sim p \vee (\sim q \vee r)) \vee ((\sim p \vee \sim r) \vee (\sim p \vee \sim q))$

$(p \wedge \sim(\sim q \vee r)) \vee ((p \wedge r) \vee (\sim p \vee \sim q))$

$(p \wedge (q \wedge \sim r)) \vee (p \wedge r) \vee \sim p \vee \sim q$

$(p \wedge q \wedge \sim r) \vee (p \wedge r) \vee \sim p \vee \sim q = A$

$\to \sim A =$

$\sim(p \wedge q \wedge \sim r) \wedge \sim(p \wedge r) \wedge p \wedge q$

$(\sim p \vee \sim q \vee r) \wedge (\sim p \vee \sim r) \wedge p \wedge q$ CNF

(b)

① $\sim p \vee \sim q \vee r$

② $\sim p \vee \sim r$

③ p

④ q

→ we got $p \wedge \sim p$

→ $\sim A$ False

→ A satisfiable

⑤ $\sim p \vee \sim q$ (1, 2)

⑥ $\sim q \vee r$ (1, 3)

⑦ $\sim p \vee r$ (1, 4)

⑧ $\sim r$ (2, 3)

⑨ $\sim p$ (2, 7)

2. Yes for example

$A = (p \wedge q \wedge r) \rightarrow T$

$= \sim(p \wedge q \wedge r) \vee T$

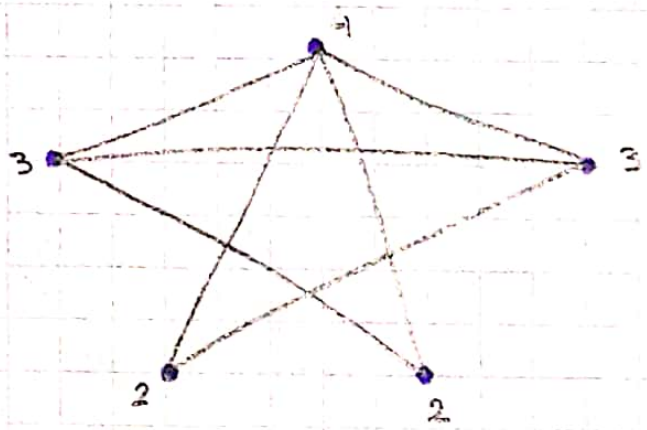
$= \sim p \vee \sim q \vee \sim r$

3.

(a) 4, 3, 3, 1

No, because we have vertix with degree 4 and we have just 4 vertices.

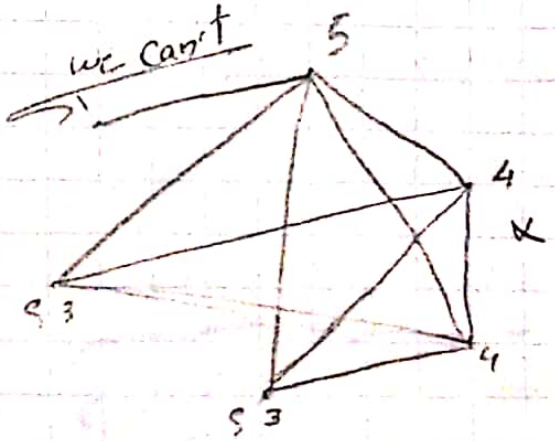
(b) 4, 3, 3, 2, 2 yes, for example!



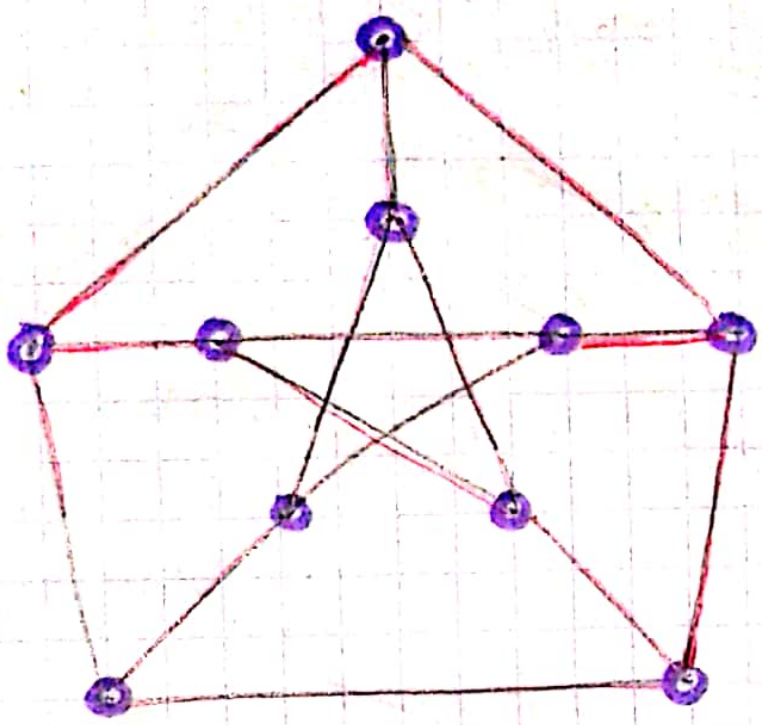
(c) 5, 4, 4, 2, 2, 1

No, we can't

because we have two vertices with ~~degree~~ degree 2



4. peterson graph



5. for example k_2 , k_{11} (two component)
so there are no path between them,
so not always there are apath.

6. $\{ww^R \mid w \in \{0,1\}^*\}$