REVIEW EXERCISE 05

Question 1. Given a knowledge base KB as follows, $\{\mathbf{P \rightarrow R},\ \neg\mathbf{S} \rightarrow \mathbf{P},\ \neg\mathbf{S},\ \mathbf{R \rightarrow Q}\}$. Consider the pseudo-code function PL-RESOLUTION given in the lecture to check whether **KB entails Q**.

Present your work to the table below, in which the first column contains KB $\wedge \neg\alpha$ in CNF, and every of the next columns includes new sentences added to KB after each loop. Note that

- Duplicated sentences are omitted from the table
- *Circle the unit clauses that lead to the contradiction and hence the function ends successfully, if possible*
- Process the clauses in order, that is first pair clause 1 with clause 2, 3, 4… then pair clause 2 with clause 3, 4,… and so on.

CNF sentences	Loop 1	Loop 2	Loop 3	Loop 4
$\neg P \vee R$	$S \vee R$	R		
$S \vee P$	$\neg P \vee Q$	$S \vee Q$		
$\neg S$	P			
$\neg R \vee Q$				
Q				

Circle the correct option, IS or IS NOT.

Following the result of resolution, the sentence Q **IS** / **IS NOT** entailed by KB.

Question 2. Repeat Question 1. but this time you check whether **KB entails ¬Q**.

Question 3. Are the above problems solved by using Forward chaining or Backward chaining? Give your reason.

$P \rightarrow R$

Question 4. Consider the following text. "*Heather attended the meeting* or Heather was not invited. If *the boss wanted Heather at the meeting*, then *she was invited*. Heather did not attend the meeting. If the boss did not want Heather there, and the boss did not invite her there, then *she is going to be fired*."
Use resolution to prove that **Heather is going to be fired**. *Hint: clauses in italic are good candidates for propositions.*
Let each of following propositions denote the facts represented in the corresponding clause.

- Proposition A represents for "Heather attended the meeting."
- I
- W
- F

Then the propositional KB in CNF will be

1) A ∨ ¬I
2) ¬W ∨ I
3) ¬A
4) W ∨ I ∨ F

Apply resolution to KB ∧ ¬α

5) ¬F — Negation of conclusion
6) ¬I — from sentences 3 and 1
7) ¬W — from sentences 6 and 2
8) F — from sentences 6 and 7, 4
9) • — from sentences 5 and 8

Conclusion: Therefore, Heather is going to be fired

Question 5. Consider the following knowledge base of definite clauses.

1. ~~C ∧ D → Y~~
2. ~~R ∧ Z → C~~
3. ~~¬B ∨ D~~ B → D
4. ~~¬D ∨ ¬R ∨ Z~~ D ∧ R → Z
5. B
6. ~~R → D~~
7. ~~D → R~~

Prove **Y** using backward chaining and forward chaining. In forward chaining, we only trigger a rule once for simplicity.

8. D
9. R
10. Z
11. h
12. C

~~1~~ 12 Y