

Homework 2

Due: Monday, April 16, 01.

Do *only* one of each group.

Group 1:

Question 1-1: Depending only on what was presented in class, comment on the statement:

Unless $P = NP$, there must exist problems in $NP - P$ that are not NPC .

Note: *Prove everything you could and state what scientists expect.*

Question 1-2: Let C be a complexity class. Let $A = coC$ and $B = C - complete$. Prove or disprove the following:

$$A - complete = coB.$$

Group 2:

Question 2-1: Prove that if $P \cap NPC \neq \phi$, then $P = NP$.

Question 2-2: Prove or disprove the following statement:

If C is a complexity class and $D = C - complete$, then $D - complete$ is equal to $C - complete$.

Group 3:

Question 3-1: Prove or disprove the following statement:

For any two complexity classes C_1 and C_2 , $co(C_1 \cup C_2) = coC_1 \cup coC_2$.

Question 3-2: Is it *likely* that $NPC \cap coNPC \neq \phi$? Prove your claim.

Group 4:

Question 4-1: Prove or disprove the following statement:

$$NP = P \cup NPC \implies coNP = P \cup coNPC.$$

Question 4-2: Prove or disprove the following statement:

$$NP \neq coNP \implies NP \neq coP.$$

Group 5:

Question 5-1: Prove that $coNP \subseteq NP - easy$.