1. • How would you show that a language L is in P?

    • How would you show that a language L is in NP?

    • How would you show that a language L is NP-complete?

    • How would you show that a language L is undecidable?

    • How might you show that a language L is *not* NP-complete?

2. Are the following problems in P, NP-complete, decidable, semi-decidable and not decidable, or none of the above? Prove your answers.

    (a) $\{\langle M\rangle :$ for some x, $M(x)\downarrow$ and $M(x+1)\downarrow\}$

    (b) $4\text{Sat} = \{\varphi; \varphi$ is in 4CNF and is satisfiable$\}$

    (c) $\{(\langle M\rangle, x) : M(x)\downarrow$ in $\leq 2^{2^{|x|}}$ steps$\}$

3. True or False? (Prove or give counterexamples.)

    (a) If L_1 and L_2 are both semi-decidable, then $L_1 \cap L_2$ is semi-decidable.

    (b) If L is NP-complete then L is semi-decidable.

    (c) If $L_1 \subset L_2$ and L_1 is NP-complete, then L_2 is NP-complete.

4. Show that Hamiltonian Path $\leq_m^P$ Hamiltonian Cycle.