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) $\{\langle M \rangle : \text{for some } x, M(x) \downarrow \text{ and } M(x + 1) \downarrow \}$
   (b) $4\text{Sat} = \{\varphi; \varphi \text{ is in 4CNF and is satisfiable}\}$
   (c) $\{\langle (M), x \rangle : M(x) \downarrow \text{ in } \leq 2^{2^{|x|}} \text{ steps}\}$

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 $\leq^P_m$ Hamiltonian Cycle.