Problem 1: True, False or Open. Correct = 1, incorrect = -1, no answer = 0.

T F O Each finite language is decidable

T F O If $L$ is Turing recognizable then so is $\bar{L}$ (the complement)

T F O If $L$ is Turing-recognizable and $L' \subseteq L$ then $L'$ is also Turing-recognizable

T F O If $A$ and $B$ are Turing-recognizable then $A \cup B$ is also Turing-recognizable

T F O $A_{TM}$ is Turing-decidable

T F O $\overline{\text{All}_{CFG}}$ is Turing-recognizable

T F O $A_{TM} \leq_m \text{All}_{CFG}$

T F O PCP is Turing-recognizable

T F O If $A, B \in \text{NP}$ then $A \cup B \in \text{NP}$

T F O If $A \in \text{NP}$ and $B \leq_P A$ then $B \in \text{NP}$
Problem 2: (a) Give a complete formal definition of a non-deterministic Turing machine.

(b) Give a complete definition of the Post Correspondence Problem.
Problem 3: Prove that $L$ is Turing recognizable if and only if there is an enumerator that enumerates $L$. 
Problem 4: Is the following problem decidable? Give a proof.

TmAllStates

Instance: a Turing Machine $M$, a string $w$;

Query: Does $M$ use all its states in the computation on $w$?

(We say that $M$ uses its state $q$ if it enters $q$ at least once.)
Problem 5: Is the following problem decidable? Give a complete proof.

EpsTM

Instance: a Turing Machine $M$;
Query: Does $M$ accept the empty string?