1) 10 pts

For each of the following sentences, state whether the sentence is known to be TRUE, known to be FALSE, or whether its truth value is still UNKNOWN.

(a) If a problem is in P, it must also be in NP.

TRUE.

(b) If a problem is in NP, it must also be in P.

UNKNOWN.

(c) If a problem is NP-complete, it must also be in NP.

TRUE.

(d) If a problem is NP-complete, it must not be in P.

UNKNOWN.

(e) If a problem is not in P, it must be NP-complete.

FALSE.

If a problem is NP-complete, it must also be NP-hard.

TRUE.

If a problem is in NP, it must also be NP-hard.

FALSE.

If we find an efficient algorithm to solve the Vertex Cover problem we have proven that P=NP

TRUE.

If we find an efficient algorithm to solve the Vertex Cover problem with an approximation factor $\rho \geq 1$ (a single constant) then we have proven that P=NP

FALSE.

If we find an efficient algorithm that takes as input an approximation factor $\rho \geq 1$ and solves the Vertex Cover problem with that approximation factor, we have proven that P=NP.

TRUE.