**Problem 1**

We show that if Prob1 Prob2 and Prob2 Prob3, then Prob1 Prob2

Let p(y) be a polynomial and C an algorithm, I1 is an instance of Prob1 with input data X1 of size n, C produces in O(p(n)) time input data X2 for I2 of Probl2. So I1 has a solution iff I2 has a solution.

Same with q(y) be a polynomial and D an algorithm, J2 is an instance of Prob2 with input data Y2 of size n, D produces in O(p(n)) time input data X3 for J3 of Probl3. So J2 has a solution iff J3 has a solution.

Let r(y) = q(p(y); notice r(y) is a polynomial.

Define an algorithm E that accepts input data for instances of Prob1

For each input data X1 of I1 of Probl1, E performs the steps of C to produce input data X2 for instance I2 so that I1 has a solution iff I2 has a solution. And so on, I1 has a solution iff I3 has a solution.

**Problem 3**

Suppose R is an NP problem.

We must show that R TSP.

We have R HC TSP

The first is because HC is NP-complete; the second is because of the fact shown previously.  
  
It now follows from Problem 1 that R TSP.

Alternatively, just show HC TSP and show that TSP in in NP.

Since HC is an NP-Complete problem and it can be reduced to TSP and TSP belongs to NP, TSP is an NP-Complete problem.

**Problem 5**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | 0 | 1 | 2 | 3 | 4 |
| (3) S0 | {} | NULL | NULL | {3} | NULL |
| (2) S1 | {} | NULL | {2} | {3} | NULL |
| (1) S2 | {} | {} | {2} | {3} | {3,1} |
| (5) S3 | {} | {1} | {2} | {3} | {3,1} |