HOMEWORK 3. Written Morally Due Feb 18. Oral DUE Feb 20

1. (40 points) Assume Graph Isom is in P. Show that the following function can be computed in poly time
   - INPUT two graphs $G_1, G_2$
   - OUTPUT
     (a) If $G_1$ and $G_2$ are not isomorphic than output NO.
     (b) If $G_1$ and $G_2$ are isomorphic than output an isomorphism.

2. (50 points) TO BE GIVEN ORALLY ON THURSDAY FEB 20. (See below) So you can get a headstart.) Prove that Hamiltonian Cycle is NP-complete. Do this by showing $3$-SAT $\leq$ HAMCYCLE. There are proofs of this on the Web- just Google ”Hamiltonian Cycle is NP-complete” and you’ll fine some (I found some great slides by Carl Kingsford who used to be here but is now at CMU.)
   Th 10-11: Jesse M, Emily H, Yi Q,
   Th 11-12: Casey M, Leo F, Hoseein E.
   Th 3:30-4:30 Bahadir O, Ahmed A, Ilse H

3. (0 points but will be a later Oral HW so take a look.) Prove that $NSPACE(\log n) \subseteq DSPACE((\log n)^2)$. The proof must be from first principles (e.g., you can’t say ‘this follows from Savitch’s theorem’). HINT- this is a special case of Savitch’s theorem. You should look up Savitch’s theorem, read it, and understand it completely. It first appeared in Relationship between nondeterministic and deterministic space classes by Savitch, Journal of Computing and Systems Sciences, Volume 4, 177-192, 1970. It is also in most complexity theory textbooks and there are probably notes on line about it.