

## CSC373 Winter 2015 Problem Set # 8

Name: Weidong An

Student Number: 1000385095

UTOR email: weidong.an@mail.utoronto.ca

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1. Incorrect.

The reduction function does not preserve answers. Consider the graph  $G = (\{a, b\}, \{(a, b)\})$ . Clearly, there are even no cycles in  $G$ , but there is a Hamiltonian path  $(\{(a, b)\})$ . Also, this is not actually a proof but just a restatement of the result.

2. Incorrect.

The direction is not correct.  $HP \leq_p HC$  does not imply  $HP$  is  $NP$ -hard.

3. Incorrect.

The reduction function depends on  $C$  which is not part of the input. Also, it lacks detailed argument of the "iff".

4. Correct.

5. Incorrect.

The last part of the proof: the Hamiltonian path may not start from  $v_1$ . Consider a counter example:  $G = (\{v_1, v_2, v_3\}, \{(v_1, v_2), (v_2, v_1), (v_3, v_1)\})$ .

Then  $G' = (\{v_1, v_2, v_3, v'_1\}, \{(v_1, v_2), (v_2, v_1), (v_3, v_1), (v_2, v'_1), (v_3, v'_1)\})$ .

Note that  $(v_3, v_1), (v_1, v_2), (v_2, v'_1)$  is a Hamiltonian path for  $G'$ , but there is no Hamiltonian cycle in  $G$ .