

## CS 487 – Assignment 8

1. Read the description of Generalized Geography and the proof of its PSPACE-completeness in Sipser, pages 289–293. Consider the modified problem GG-edge which is the same as Generalized Geography except that players are allowed to repeat vertices but they cannot repeat edges. Show that GG-edge is also PSPACE-complete.
2. Not all games are PSPACE-complete. Show that HAPPY-CAT, as described in Sipser, problem 8.15, page 303, is in P.
3. Let  $s_1(n)$  and  $s_2(n)$  be space-computable functions such that  $s_1(n) = o(s_2(n))$ . Show that

$$\text{NSPACE}(s_1(n)) \subsetneq \text{NSPACE}(s_2(n)).$$

Hint: Use the fact, which we proved in class, that  $\text{NSPACE}(s(n)) = \text{co-NSPACE}(s(n))$  for all  $s(n)$ .

4. Show that  $\text{P} \neq \text{DSPACE}(n^2)$ . Note that it is open whether  $\text{P} \subseteq \text{DSPACE}(n^2)$  and whether  $\text{DSPACE}(n^2) \subseteq \text{P}$  but you need to show that both possibilities cannot be true.