CPSC 413: Exercise Set 11

1. A computer has m different resources it can use (hard drive/monitor/sound card/etc.). At a particular time, the computer is trying to run n different processes. Each process needs to use some subset of the different resources (one process might just need the hard drive and sound card, for example). At each particular instant, each resource can only be used by one process. The computer needs to decide which of the n processes to allow to run, so that each resource is only used once. In particular, given a number $k \geq 0$, the problem is to determine whether you can run k or more different processes so that no two resources are being used at the same time. Call this problem **ResourceRequest**.

   (a) Show that **ResourceRequest** is in NP.

   (b) Show that **IndependentSet** $\leq_p$ **ResourceRequest**.

2. Consider the following problem: you have received m applications from potential counsellors for your summer camp. You have n sports that you run at the camp, and want to select applicants so that every sport can be run by some counsellor. Each of the applicants has indicated which of the n sports they could run. Given a number $k \geq 0$, the problem is to determine whether you can hire k or fewer counsellors so that each of the sports can be run by at least one counsellor. Call this problem **CampRecruit**.

   (a) Show that **CampRecruit** is in NP.

   (b) Show that **VertexCover** $\leq_p$ **CampRecruit**.