Joey Cheung Special Lecture Notes

1. Partition
   (a) $Max - Cut \in NP$
   (b) For a graph, a maximum cut is a cut whose size is at least the size of any other cut. The problem of finding a maximum cut in a graph is known as the Max-Cut Problem.
   (c) $Min - Cut \in P$
   (d) In graph theory, a minimum cut or min-cut of a graph is a cut that is minimal in some sense
   (e) 2-partition. Karp uses 2 partition but the standard is using K partitions (Base 10 to base K)
   (f) π is another way of saying partition
   (g) partition $\pi(S)$
   (h) k-partition $\pi(S, K)$
   (i) The partition problem, or number partitioning, is the task of deciding whether a a multiset of positive integers can be partitioned into two subsets.
   (j) $US_i = S$
2. Graphs
   (a) $G = (V, E)$
   (b) $E \subset VxV$
3. Formula for partition in Rosen's book

$$(n^m \sum_{i=1}^{n-1} (-1)^{i+1} \binom{n}{i} (n-i)^m)/n!$$

4. Another formula

$$2^n = \sum_{i=n}^{n} \binom{n}{i}$$

5. Permutation
   (a) Permutation has i! permutations for 1 combination
   (b) $n!/(n-i)!$

6. Combination
   (a) Combination formula
   (b) $n!/(n-i)!n$
7. Mutually Exclusive
   (a) Intersectional requirement, may not span "U"
8. Problems
   (a) Set packing: L boxes - no duplication
   (b) Set packing is a classical NP-complete problem in computational complexity theory and combinatorics, and was one of Karp's 21 NP-complete problems.
   (c) Set covering: Boxes covers all items U, (But may not be mutually exclusive)
   (d) The set cover problem is a classical problem in computer science and is one of Karp's 21 NP-complete problems
   (e) Exact cover: Up to Hboxes
   (f) The exact cover problem is NP-complete and is one of Karp's 21 NP-complete problems. The exact cover problem is a kind of constraint satisfaction problem. The exact problem is a problem that sees if you can have an exact cover.