Randomized Algorithms. Exercises for 17.11

pr.5.5 Use probabilistic method to show existence of an expanding bipartite graph (L,R,E) with the following properties:

- $|L| = |R| = n$.
- Every vertex in L has degree $n^{3/4}$, and every vertex in R has degree at most $3n^{3/4}$.
- Every subset of $n^{3/4}$ vertices is L has at least $n - n^{3/4}$ neighbors in R.

pr.7.16 Use definition of IP to directly get:

- $NP \subseteq IP$,
- If definition of IP is modified to require probability of error being zero, then the resulting class in NP,
- $co - RP \subseteq IP$.

pr.7.16 Show that $IP \subseteq PSPACE$

pr.7.18 Define MIP as an extension of IP, where the verifier has access to two provers who cannot communicate with each other. Show that $MIP = PCP$.

pr.7.19 Show that:

- $P = PCP[0, 0]$,
- $NP = PCP[0, poly(n)]$,
- $co - RP = PCP[poly(n), 0]$.