1. Questions 5 and 6 from Problem Set 2.

2. Perform a simple switching (such as the one in Lemma 5.11 of the notes) to obtain an upper bound on the probability of an edge av, $a \in A$ and $v \in V$, when G is drawn u.a.r. from $\mathcal{G}(\mathbf{s}, \mathbf{t})$ for a bi-degree sequence $(\mathbf{s}, \mathbf{t})$. Is your upper bound better or worse or the same as the one in Lemma 5.11 for graphs?

3. Adapt the recursive formulae for P_{av} and Y_{avb} to the bipartite model when $a, b \in A$ and $v \in V$.

4. Recall the Erdős–Gallai conditions from Problem Set 1 for a sequence $\mathbf{d}$ to be graphical. Show that every even $\mathbf{d} \in \mathcal{B}_8(\mathcal{D}_m)$ is graphical, provided that $n \log n \ll m \leq n^2/10$, say.

   You may make your live easier by assuming that $d_1 \geq \ldots \geq d_n$ and only checking the condition for sets $S = [k]$, for all $k \geq 1$ (i.e. you may assume that S contains the $|S|$ largest degrees of $\mathbf{d}$).

5. Convince yourself that

$$\frac{\mathbf{y}_{\mathbf{d}-\mathbf{e}_a}}{\mathbf{y}_{\mathbf{d}-\mathbf{e}_b}} = \frac{d_a}{d_b}\left(1 + \frac{d_a - d_b}{dn}\left(1 + \frac{M_2(\mathbf{d})}{dn}\right) + O\left(\frac{d^2 \log^2 n}{n^2}\right)\right),$$

   where $\mathbf{y}_{\mathbf{d}} = \Pr(\mathcal{B}_m(n) = \mathbf{d}) \exp\left(\frac{1}{4} - \frac{\gamma_2^2(\mathbf{d})}{4\mu^2(1-\mu)^2}\right)$ is the conjectured formula for $\Pr(D(G_{n,m}) = \mathbf{d})$.

6. Let $\mathbf{d} = D(G_{n,m})$. What is $\mathrm{Var}(d_1)$?