MAS334 EXAM INFORMATION

The exam will consist of 12 questions of varying lengths. You are asked to complete all questions.

The following sections of the notes were not covered in lectures and will not be examined:

- Definition 11.9 to the end of Section 11
- Example 14.24 to the end of Section 14.

The exam will ask you to solve various problems. In some cases you will just need to apply a method that has been explained explicitly in lectures. However, there will also be many cases where you will need to be more creative, and use an adapted version of a method from the notes, or do something analogous. For these questions, it will be helpful for you to be familiar with

- All the questions on problem sheets (for which there are solutions on the course home page)
- Recent past exam papers (for which there are solutions on the course home page)
- All the examples in the notes (excluding the sections that were not lectured).

The exam will also ask you to state some definitions or results, and reproduce some standard proofs. These will be taken from the list below. You will only be asked to reproduce proofs for results marked [Proof]. However, familiarity with other proofs may still be useful for solving various problems.

- Corollary 1.13: Size of $P_k A$ (subsets of size k) [Proof]
- Proposition 1.19: Pascal relation $\binom{n}{k} = \binom{n-1}{k} + \binom{n-1}{k-1}$ [Proof]
- Proposition 1.23: Number of gappy sets [Proof]
- Proposition 2.1: Number of positive solutions [Proof]
- Proposition 2.4: Number of nonnegative solutions [Proof]
- Problem 2.7: Number of routes across a grid [Proof]
- Proposition 2.9: Extended Pascal relation $\binom{n}{k} = \sum_m \binom{m-1}{k-1}$
- Proposition 4.2: Pigeonhole principle
- Theorem 5.3: Inclusion-Exclusion Principle
- Definition 5.8: Derangements
- Proposition 5.11: Number of derangements [Proof]
- Proposition 5.13: Proportion of numbers coprime with m
- Definition 6.1: Matching problem
- Proposition 7.10: Full matchings and permutations
- Proposition 7.11: Rook polynomial of a full board [Proof]
- Theorem 8.1: Blocking and stripping relation for rook polynomials
- Theorem 8.7: Rook polynomial factoring theorem
- Theorem 10.3: Number of full matchings on the complementary board
- Definition 11.2: Plausibility for matching problems
- Lemma 11.5: Implausible problems are not solvable [Proof]
- Theorem 11.6: Hall's Marriage Theorem: Plausible problems are solvable
- Definition 12.9: Plausibility for team allocation problems
- Proposition 12.11: Plausible team allocation problems are solvable
- Definition 13.1: Tournaments
- Definition 13.6: Winning line
- Proposition 13.9: Every tournament has a winning line [Proof]
- Proposition 13.18: Equivalence of various plausibility conditions
- Definition 13.19: Plausibility for score sequences
- Theorem 13.22: Plausible score sequences are realisable
- Definition 14.1: Latin rectangles
- Definition 14.10: Multiplicity and excess
- Theorem 14.22: A plausible latin rectangle can be extended to full size
- Definition 15.1: Block design
- Proposition 15.4: $bk = vr$ and $bk(k-1) = \lambda v(v-1)$ and $r(k-1) = \lambda(v-1)$
- Corollary 15.23: $b \geq v$