Math 70 Essentials

I. Probability. Sample space, probability function, equally likely assumption.

• $P(A \cup B)$, $P(E')$, $P(A|B)$ (conditional probability), $P(A \cap B)$ (independent events)
• Probability trees
• Bayes’s formula: $P(U_1|E) = (\text{product leading to } E \text{ via } U_1)/(\text{sum of products leading to } E)$
• Random variables and probability distributions; payoff tables and expected value $E(X) = x_1p_1 + \cdots + x_np_n$; expected value of a game
• Markov chains: transition diagram, transition matrix $P$, initial state matrix $S_0$, $S_1 = S_0P$, $S_2 = S_1P = S_0P^2$, etc.

II. Systems of linear equations and matrices. Solution sets, number of solutions

• Augmented matrix of a system, elementary row operations
• Reduced row echelon form
• Gauss-Jordan elimination
• Basic matrix operations: $A + B$, $\lambda A$, $AB$ where $(m \times k) \cdot (k \times n)$
• Identity matrix $I$, inverse of a matrix $(AA^{-1} = A^{-1}A = I)$, computing the inverse: $[A|I] \rightarrow [I|A^{-1}]$
• Solving systems using matrices ($AX = B \rightarrow X = A^{-1}B$), solving matrix equations

III. Linear Programming. Graphing of inequalities, feasible region

• Geometric approach to solving linear programming problems (corner points)
• Slack variables, basic and non-basic variables, basic feasible solutions
• Simplex method: initial system and simplex tableau, selecting the basic variables and the pivot, pivot operation, entering and exiting variables, stopping the algorithm, optimal solution
• Minimization problems: forming the dual maximization problem

IV. Sets and counting. ¹ Basic set operations ($\cup, \cap, '$)

• Basic counting principles: addition and multiplication principle
• Permutations (order important) $P_{n,k} = n!/(n-k)!$
• Combinations (order unimportant) $C_{n,r} = \frac{n!}{r!(n-r)!}$

¹I depends on IV