Math 70 Essentials

I. Mathematics of finance. Main topics:

- Simple interest: \( A = P(1 + rt) \)
- Compound interest: \( A = P(1 + i)^n \), \( i = r/m \)
- Future value of an annuity: \( FV = PMT\frac{(1+i)^n-1}{i} \). Sinking funds.
- Present value of an annuity: \( PV = PMT\frac{1-(1+i)^{-n}}{i} \). Amortization.

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: \([A|I] \rightsquigarrow [I|A^{-1}]\)
- Solving systems using matrices \((AX = B \rightsquigarrow X = A^{-1}B)\), solving matrix equations

III. Linear Programming and the simplex method. 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. Basic set operations (union, intersection, complement)

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

V. 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