The thematic structure of the course *Gambling Mathematics*
(detailed content structure broken down by lessons will be posted soon)

Module 1 – <u>Basic mathematical notions</u> (10 lessons): Functions, sets, and operations with sets; Combinations; Combinatorial computation specific to games of chance; Gaming-specific applications; Sequences and convergence, limits, properties; Basic probability-theory concepts – Boole algebra, events, field of events, sample space, probability field, probability on a finite field of events; The probability function; Conditional probability; Gaming-specific applications; Properties of probability – total probability formula, the inclusion-exclusion principle, Bayes' theorem; Gaming-specific applications; Random variables and their properties; Classical probability distributions and their formulas; Basic statistics concepts – statistical series and statistical indicators (mean, median, expected value, dispersion, volatility); Gaming-specific applications.

Module 2 – <u>The nature, interpretations and use of probability</u> (4 lessons). Randomness and uncertainty; Frequency and relative frequency; Probability as a measure; Probability as a limit – Central limit theorem; Theoretical interpretations of probability – Classical probability, inductive probability, frequential probability, propensic probability; Objective and subjective probability; Infinity as constitutive for probability; The limitations and relativities of probability; Mathematical probability and the common-sense concept of probability; Tricky perceptions and misconceptions about probability; Probability and possibility; The use of probability theory in gambling.

Module 3 – <u>Mathematical models of gambling and applications</u> (10 lessons). What is a mathematical model, functions and outcomes of a model; Mathematical modeling and the factual reality; The mathematical models of the games – functional models and statistical models; The mathematical description of game characteristics/design – awareness and ethics; Bets; Probabilities and odds; House edge; Computing the probabilities of the gaming events; The inclusion-exclusion principle and other properties of probability applied; Simple and complex gaming events; Immediate probabilities and long-shot probabilities; Own probabilities and opponents' probabilities; Comparison of probabilities, weighting; Strength (potential) and probabilities, strength indicators; Gaming-specific applications; General probability formulas with variables; The use of probability table/charts and software; Summation of partial probabilities; Methods of quick estimation and approximation of hardly-computable probabilities; Probability of repetitive gaming events; Repetitive betting systems – Martingale, D'Alembert, Fibonacci; Gaming-specific applications; Expected value and probability as decision criteria.

Module 4 (game-specific module): Texas Hold'em Poker (8 lessons) / Roulette (4 lessons) / Blackjack (3 lessons)

Texas Hold'em Poker module (8 lessons):
Sample space and probability fields in Hold'em Poker; Simple and complex events in the poker game; Immediate probabilities and long-shot probabilities; Own hand probabilities and opponents' hands probabilities in every stage; Probability formulas; Estimating and

approximating the poker probabilities – Selecting dominant probabilities and types of card formations, reducing the calculation formulas, approximating the probability of an union through the inclusion-exclusion principle; Using external resources for finding probabilities; Probability-based analyses of concrete Hold'em hands; Opportunity indicators (pot odds, implied odds, pot equity) and their interpretation; The probability-based strategy in Hold'em Poker; The mathematical strength of a hand; The strategic use of the opportunity indicators together with hand probabilities; Applications and exercises.

Roulette module (4 lessons):
Sample space and probability fields in roulette; Simple and complex bets; The profit function; The topology of placements; Equivalence of bets; Reducing and transforming bets through equivalence; Improving bets with respect to probability of winning – High-coverage betting systems; The balance between probability of winning and expected value; Repeated bets – probabilities and expectations; The roulette martingale – mathematical proof and sustainability. Applications and exercises.

Blackjack module (3 lessons):
Sample space and probability fields in Blackjack; Sum partitions; Probability of a sum; Probabilities of being dealt specific hands; Probability of being dealt a favorable next card – general formula, for the own hand and dealer's; Probability of acquiring a certain sum with the next two cards dealt for the own hand and dealer's; Estimating and approximating long-shot probabilities (three or more cards to come); The probability-based strategy of blackjack – weighting and comparing the own hand's probabilities with dealer's. Applications and exercises.

Module 5 – <u>Gaming strategy and objectivity of the gambling decisions</u> (5 lessons): Strategic criteria; Relativity of the strategy; Probability-based strategy and optimal play; Mathematical description of the common gambling misconceptions and fallacies – unrealistic expectations, subjective non-rational estimations, erroneous strategy, conjunction fallacy, near miss effects, the "winning systems", frequentist belief criterion; Responsible gambling with gambling-mathematics knowledge.

Rules, terms, and conditions

- The lessons are delivered on a biweekly basis, usually Tuesday and Friday in Google Drive (a Google account is necessary for using Drive and accessing your written lessons).
- A lesson is delivered along with the solutions to the exercises proposed as homework in the previous lesson.
- The knowledge evaluation tests are delivered once or twice during a module. Case studies are proposed for discussion on the chat/forum platform.
- The question-answer sessions take place following each lesson, having as their subject the previous lesson. All questions (maximum 5) should be sent together in one message, having in the subject line your name and the number of the lesson to which they apply (example: "John Smith – lesson 3"). The questions should concern issues of understanding and unclear points from the previous lesson, with no requests for calculations or solutions to problems. Students

will receive answers to their questions in email before the next lesson; the answers cannot stand as a basis for new questions.

- The knowledge evaluation tests can be completed and sent by the student at any time. Tests will be returned corrected in a reasonable time. It is recommended that each test be completed and returned prior to the next lesson.

- Course fees should be paid in advance, in full or in part. A partial payment must cover at least one module and is not refundable. If payment for several modules was made and the student decides to withdraw from the course, the student will be refunded only the amount corresponding to the modules not yet started. A student may, however, temporarily suspend participation and resume at a later date.

- Deviations from the delivery timeframe are possible, depending on the undetermined working volume of the interactive sessions or unpredictable circumstances. In the case of unpredictable circumstances, the course can be suspended at any time and resumed at a later date.

- The delivery of the course will have a 2-week break in the summer time (July-August) and a 2-week break in the spring time (April-May); participants will receive prior notice of the dates for the break.

- The delivered lessons and the evaluation tests hold the copyright of their authors. Copying, distributing, or posting them on the internet are not allowed. Any such attempt will be subject to legal action against the copyright infringer. Submission of the registration form constitutes awareness and acceptance of these terms and conditions.

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