SYLLABUS

1. Information about the study program

1.1 Higher education institution	Babeș-Bolyai University
1.2 Faculty	Faculty of Psychology and Educational Sciences
1.3 Department	Department of Psychology
1.4 Field of study	Psychology - Cognitive Sciences
1.5 Study cycle	Bachelor level
1.6 Study program / Qualification	Psychologist

2. Information about the course

2.1 Title of the course	Logic and Reasoning						
2.2 Teacher in charge of the lecture	Lecturer Dr. Adrian Ludușan						
2.3 Teacher in charge of the seminar	Lecturer Dr. Adrian Ludușan						
2.4 Study year	1	2.5 Semester	2	2.6. Examination type	E	2.7 Course type	OB

3. Estimated total time (number of hours of teaching activities per semester)

3.1 Number of hours per week	3	out of which: 3.2 lecture	2	3.3 seminar / laboratory	1
3.4 Total number of hours in the curriculum	42	out of which: 3.5 lecture	28	3.6 seminar / laboratory	14
Distribution of the allocated amount of time:					hours
Individual study (textbook, course support, bibliography, and notes)					17
Supplementary documentation at the library using specialized electronic platforms in the field					19
Preparing for seminars / laboratories, homework, papers, portfolios, and essays					28
Tutoring					17
Exams					2
Other activities					

3.7 Total number of hours of individual study	83
3.8 Total number of hours per semester	125
3.9 Number of credits (ECTS)	5

4. Prerequisites (if applicable)

4.1 Curriculum	-
4.2 Competencies	-

5. Requirements (if applicable)

5.1 For the lecture	• Classroom with at least 180 seats, computer and video projector / Online course conducted through the MS Teams platform.
5.2 For the seminar / laboratory	• Room with at least 50 seats, computer and video projector / Online seminar conducted through the MS Teams platform.

6. Specific skills acquired

Professional skills	**Knowledge and understanding** • Evaluate the validity of arguments using semantic/analytic tableaux • Evaluate the validity of arguments using the truth table method • Construct rigorous proofs using natural deduction systems • Evaluate the soundness of arguments • Discern various types of reasoning • Discern the logical structure of the argument/reasoning • Identify hidden assumptions and/or premises in arguments and reasonings **Explanation and interpretation** • Interpret arguments, ideas, theses according to the principle of charity • Explain key concepts and distinctions in the logical approach to arguments/reasoning **Instrumental - applicative** • Use semantic/analytic tableaux to determine the validity of arguments/reasonings • Use truth tables to determine the validity of arguments/reasonings • Use natural deduction systems to construct rigorous proofs • Supplement precarious arguments/reasonings in order to become valid/sound • Develop valid, sound, arguments in scientific writing **Attitude** • Manifest a critical-thinking approach to discourses, ideas, theses, arguments, available information, generally. • Manifest an analytical-thinking approach to problems, puzzles, etc. • Manifest a scientifically-oriented approach.

Transversal skills	• Develop rigorous, sound, evidence-based arguments • Identify fallacies and biases in scientific/everyday discourses • Identify the logical joints, hidden assumptions, and premises of arguments • Logically and critically evaluate arguments • Asses the consistency of beliefs, ideas, theses, and premises • Use a critical thinking approach to discourses, ideas, arguments, problems • Develop analytic thinking skills • Structure information in a sound logical manner • Communicate ideas and arguments eloquently and more effectively

7. Objectives of the course (based on the grid of acquired competencies)

7.1 General objective	• Familiarize students with the formal and informal procedures for evaluating the validity of arguments. • Familiarize students with logical and cognitive approaches to reasoning.
7.2 Specific objectives	• Present traditional, truth table-based, and state of the art (semantic/analytic tableaux) proof procedures for testing the validity of arguments/the consistency of propositions/beliefs, and automated reasoning software based on semantic/analytic tableaux. • Present a version of natural deduction for propositional logic and proof assistants for natural deduction. • Classify and present criteria for evaluating reasonings. • Classify and identify logical fallacies. • Classify and identify reasoning/cognitive biases.

8. Content

8.1 Lecture	Teaching strategies	Remarks
Identifying arguments. The general structure of arguments. **Argument evaluation: basic concepts and distinctions.** **Keywords**: premises, conclusion, premise indicators, conclusion indicators, valid arguments, sound arguments, strong/weak arguments, semantic and structural ambiguities, truth values**.**	Lecture, demonstrative example, synthesis of knowledge, guided discovery	
Types of reasoning. Applications.	Lecture, demonstrative example, synthesis of knowledge, guided discovery	

Keywords: deductive reasoning, inductive reasoning, abductive reasoning**.**		
Mapping arguments: Beardsley-Thomas diagrams. **Keywords:** serial arguments, linked arguments, convergent arguments, divergent arguments.	Lecture, demonstrative example, synthesis of knowledge, guided discovery	
Nuts and bolts of propositional logic. **Keywords:** sentences, propositions, atomic sentences, compound sentences, logical connectives, regimenting sentences in propositional logic, regimenting arguments in propositional logic**.**	Lecture, demonstrative example, synthesis of knowledge, guided discovery	
Propositional logic: syntax. **Keywords:** atomic formula, propositional formula, well-formed formula, complexity of formula, propositional metavariables, parsing trees, unique readability.	Lecture, demonstrative example, synthesis of knowledge, guided discovery	
Propositional logic: semantics. **Keywords:** truth values, valuation functions, truth-value assignments, interpretation, satisfiability, consequence, model, tautology, contradiction, computation of truth values.	Lecture, demonstrative example, synthesis of knowledge, guided discovery	
Propositional logic: proof procedures for testing the validity of arguments: truth-table method. **Keywords:** validity, truth tables, validity of propositional logic arguments.	Lecture, demonstrative example, synthesis of knowledge, guided discovery	

Propositional logic: proof procedures for testing the validity of arguments: semantic/analytic tableaux. Automated reasoning with semantic/analytic tableaux. **Keywords:** semantic tableaux rules/analytic tableaux rules, validity tests.	Lecture, demonstrative example, synthesis of knowledge, guided discovery	
A proof system for propositional logic: natural deduction. Automated reasoning with natural deduction. Proof assistants for natural deduction. **Keywords:** proof, deduction, natural deduction rules, formal deductions, Gentzen style natural deduction system, Fitch style natural deduction system**.**	Lecture, demonstrative example, synthesis of knowledge, guided discovery	
Semantic/analytic tableaux & natural deduction: soundness and completeness of propositional logic. **Keywords:** soundness theorem, completeness theorem**.**	Lecture, demonstrative example, synthesis of knowledge, guided discovery	
Interlude: Cognitive aspects of reasoning. **Keywords:** Wason selection task, the conjunction fallacy**.**	Lecture, demonstrative example, synthesis of knowledge, guided discovery	
Logical fallacies. **Keywords:** formal and informal fallacies, fallacies of diversion, fallacies of structure, fallacies of relevance**.**	Lecture, demonstrative example, synthesis of knowledge, guided discovery	
Fallacies in causal reasoning.	Lecture, demonstrative example, synthesis of knowledge, guided discovery	

Keywords: causal fallacies, correlation, spurious correlation, spurious causation, mediation, moderation.		
Biases in reasoning and research. **Keywords:** confirmation bias, anchoring bias, availability bias, apophenia.	Lecture, demonstrative example, synthesis of knowledge, guided discovery	

Mandatory references:

Chiswell, I., & Hodges, W. (2007). *Mathematical Logic.* Oxford: Oxford University Press.

Graeme, F. (1994). *Modern Logic: A Text in Elementary Symbolic Logic.* New York: Oxford University Press.

Hodges, W. (2001). *Logic: An Introduction to Elementary Logic* (2nd ed.). London, U.K.: Penguin.

Kahneman, D. (2011). *Thinking, fast and slow.* New York: Farrar, Straus, and Giroux.

Kahneman, D., Slovic, P., & Tversky, A. (Eds.). (1982). *Judgment under Uncertainty: Heuristics and Biases.* Cambridge: Cambridge University Pess.

Smith, P. (2020). *An Introduction to Formal Logic* (2nd ed.). Cambridge University Press.

Stenning, K. (2002). *Seeing Reason: Image and Language in Learning to Think.* Oxford: Oxford University Press.

Tindale, C. W. (2007). *Fallacies and Argument Appraisal.* Cambridge: Cambridge University Press.

Toulmin, S. (2003). *The Uses of Argument.* Cambridge, U.K: Cambridge University Press.

Walton, D. (2006). *Fundamentals of Critical Argumentation.* Cambridge, U.K: Cambridge University Press.

!!! Note: only the chapters related to the topics taught in the lecture and the seminar are mandatory from the works mentioned above

Optional references:

Agresti, A. (2018). *Statistical Methods for the Social Sciences* (5th ed.). Boston: Pearson.

Chaffee, J. (2018). *Thinking Critically* (12 ed.). Mason, OH: Cengage Learning.

Ebbinghaus, H.-D., Flum, J., & Thomas, W. (1984). *Mathematical Logic.* New York: Springer .

Fischer, A. (2005). *The Logic of Real Arguments.* Cambridge, U.K.: Cambridge University Press.

LePore, E. (2000). *Meaning and Argument. An Introduction to Logic through Language.* Oxford, Malden MA.: Blackwell.

Nolt, J., Varzi, A., & Rohatyn, D. (1998). *Schaum's Outline of Theory and Problems of Logic* (2nd ed.). New York: McGraw-Hill.

Stanovich, K. E. (1999). *Who is Rational? Studies of Individual Differences.* Mahwah, NJ: Lawrence Erlbaum Associates.

8.2 Seminar / laboratory	Teaching strategies	Remarks
Argument and reasoning analysis: structure, types and criteria of evaluation. **Keywords:** premises, conclusion, valid arguments, sound arguments, strong/weak arguments, truth values.	Exposure, conversation	
Argument mapping: Beardsley-Thomas diagrams, Toulmin model of argument. **Keywords:** serial arguments, linked arguments, convergent arguments, divergent arguments, Toulmin schema.	Presentation, knowledge synthesis, conceptual clarification, practical activities	
Propositional logic: syntax & semantics **Keywords:** atomic formula, propositional formula, well-formed formula, complexity of formula, truth-values, valuation functions, truth-value assignment, interpretation, satisfiability, model, tautology, contradiction, computation of truth values.	Presentation, knowledge synthesis, conceptual clarification, group activities, guided discovery, practical activities	
Proof procedures for propositional logic. Applications: automated theorem provers and proof assistants.	Presentation, knowledge synthesis, conceptual clarification, group activities, guided discovery, practical activities	

Keywords: semantic tableaux rules/analytic tableaux rules, validity tests, natural deduction**.**		
Fallacies in argumentation and reasoning. **Keywords:** formal and informal fallacies, fallacies of diversion, fallacies of structure, fallacies of relevance.	Presentation, knowledge synthesis, conceptual clarification, group activities, guided discovery, practical activities	
Fallacies in causal reasoning. **Keywords:** causal fallacies, correlation, spurious correlation, spurious causation, mediation, moderation.	Presentation, knowledge synthesis, conceptual clarification, group activities, guided discovery, practical activities	
Cognitive biases. **Keywords:** confirmation bias, anchoring bias, availability bias, apophenia.	Presentation, knowledge synthesis, conceptual clarification, group activities, Guided discovery, practical activities	

Mandatory references:

Chiswell, I., & Hodges, W. (2007). *Mathematical Logic.* Oxford: Oxford University Press.

Graeme, F. (1994). *Modern Logic: A Text in Elementary Symbolic Logic.* New York: Oxford University Press.

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Enderton, H. B. (2001). *A Mathematical Introduction to Logic* (2nd ed.). San Diego: Harcourt Academic Press.

Fischer, A. (2005). *The Logic of Real Arguments.* Cambridge, U.K.: Cambridge University Press.

Hodges, W. (2001). *Logic: An Introduction to Elementary Logic* (2nd ed.). London, U.K.: Penguin.

Kahneman, D., Slovic, P., & Tversky, A. (Eds.). (1982). *Judgment under Uncertainty: Heuristics and Biases.* Cambridge: Cambridge University Pess.

LePore, E. (2000). *Meaning and Argument. An Introduction to Logic through Language.* Oxford, Malden MA.: Blackwell.

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Stenning, K. (2002). *Seeing Reason: Image and Language in Learning to Think.* Oxford: Oxford University Press.

Toulmin, S. (2003). *The Uses of Argument.* Cambridge, U.K: Cambridge University Press.

9. Correlations between the content of the course and the expectations of the representatives of the epistemic community, professional associations and representative employers in the field related to the program

The proposed lecture and seminar offer central topics in fundamental and applied research in the fields of cognitive sciences, and their approach is based on the most recent results found in the literature. The course also offers state of the art research skills that are transferable to any scientific and applied field of knowledge.

10. Evaluation

Activity type	10.1 Evaluation criteria	10.2 Evaluation methods	10.3 Weight in the final grade
10.4 Lecture	Assessment of the written exam	Written exam	60%
10.5 Seminar / laboratory	Assessment of assignments	Seminar assignment	30%
			Ex officio: 1 point
10.6 Minimum passing score is 5			

The final evaluation will be based on a written exam conducted in the exam session at the end of the second semester and of seminar assignments.
The final grade consists of:

a. Written exam 60% (maximum 6 points)
b. Seminar assignment 30% (maximum 3 points).

Date

Signature of the teacher in charge of the lecture

Signature of the teacher in charge of the seminar

Approval date in the department

Signature of the Head of the department /director