

SYLLABUS / FIȘA DISCIPLINEI
1. Information on the study programme / Date despre programul de studii

1.1. Institution / Instituția de învățământ superior	Universitatea de Vest din Timișoara
1.2. Faculty / Facultatea	Matematică și Informatică
1.3. Department / Departamentul	Computer Science (Informatică)
1.4. Study program field	Computer Science (Informatică)
1.5. Study cycle/ Ciclul de studii	Bachelor / licență
1.6. Study programme / Programul de studii / calificarea*	Computer Science / Informatică în limba engleză / Database administration / <i>Administrator baze de date - 252101; Computer network administration / Administrator de rețea de calculatoare - 252301; Analyst / Analist - 251201; Research assistant in computer science / Asistent de cercetare în informatica - 214918; Teacher in secondary schools / Profesor în învățământul gimnazial - 233002; Programmer / Programator - 251202; Software systems designers / Proiectant sisteme informatice - 251101</i>

2. Information on the course / Date despre disciplină

2.1. Title of the course / Denumirea disciplinei		Information Theory					
2.2. Teacher in charge of the course / Titularul activităților de curs		Cosmin Bonchis					
2.3. Teacher in charge of the seminar / Titularul activităților de seminar		Cosmin Bonchis					
2.4. Study year / Anul de studii	3	2.5. Semester / Semestrul	1	2.6. Examination type / Tipul de evaluare: E(xam)/C(olloquim)	C	2.7. Course type / Regimul disciplinei: M(andatory)/ E(lective)/ F(acultative)	DO

3. Estimated study time (number of hours per semester) /Timpul total estimat (ore pe semestru al activităților didactice)

3.1. Attendance hours per week / Număr de ore pe săptămână	4	out of which din care: 3.2 lecture/ curs	2	3.3. seminar/laborator	2
3.4. Attendance hours per semester / Total ore din planul de învățământ	56	out of which: 3.5 lecture / curs	28	3.6. seminar/laborator	14
Distribution of the allocated amount of time / Distribuția fondului de timp*					hours/ ore
Individual study /Studiu după manual, suport de curs, bibliografie și notițe					30
Supplementary documentation at library or using electronic repositories / Documentare suplimentară în bibliotecă, pe platformele electronice de specialitate					10
Preparing for laboratories, homework, reports etc. /Pregătire seminarii/laboratoare, teme, referate, portofolii și eseuri					40
Exams / Examinări					20

Tutoring / Tutorat		10
3.7. Total number of hours of individual study / Total ore studiu individual	100	
3.8. Total number of hours per semester / Total ore pe semestru	156	
3.9. Number of credits (ECTS) / Număr de credite	5	

4. Prerequisites (if it is the case) / Precondiții (acolo unde e cazul)

4.1. curriculum / de curriculum	Probability Theory
4.2. skills / de competențe	-

5. Requirements (if it is the case) / Condiții (acolo unde e cazul)

5.1. for the lecture / de desfășurare a cursului	<ul style="list-style-type: none"> • Cursuri online folosind Google Meet/Teams/Webex (sau alte tooluri potrivite pentru cursuri online) și Google Classroom • sau Sală de curs cu tablă și videoproiector
5.2. for the seminar, laboratory / de desfășurare a seminarului/laboratorului	<ul style="list-style-type: none"> • Laboratoare online folosind Google Meet/Teams/Webex (sau alte tooluri potrivite pentru cursuri online) și Google Classroom • sau Sala de laborator dotată corespunzător (calculatoare cu software instalat Python)

6. Acquired skills / Competențe specifice acumulate

Professional skills / Competențe profesionale	Abilities to compute the important formulas and to apply the data compression algorithms. Understanding several definitions of information.
Transversal skills / Competențe transversale	Applying algorithms for optimal codes in data compression and data transmission.

7. Objectives of the course / Obiectivele disciplinei (reieșind din grila competențelor specifice acumulate)

7.1. General objective / Obiectivul general al disciplinei	
7.2. Specific objectives / Obiectivele specifice	

8. Content / Conținuturi*

8.1. Lecture / Curs	Teaching	Remarks, details /
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	strategies / Metode de predare	Observați
1. Introduction in Information Theory <ul style="list-style-type: none"> • Communication system • Motivation, definitions 	Lectures, illustration, demonstration	2h
2. Channel capacity <ul style="list-style-type: none"> • Noiseless Binary Channel • Noisy Channel Coding Theorem 	Lectures, illustration, demonstration	2h
3. Channel Capacity <ul style="list-style-type: none"> • Zero-Error Codes • Hamming Codes • Source–Channel Separation Theorem 	Lectures, illustration, demonstration	2h
4. Fundamental quantities of information theory <ul style="list-style-type: none"> • Entropy, Joint Entropy and Conditional Entropy • Relative Entropy and Mutual Information 	Lectures, illustration, demonstration	2h
5. Data Compression <ul style="list-style-type: none"> • Entropy and compression • Kraft Inequality, Optimal Codes • Huffman Codes 	Lectures, illustration, demonstration	2h
6. Optimal codewords <ul style="list-style-type: none"> • Source Coding Theorem • Optimality of Huffman Codes • Shannon–Fano–Elias Coding 	Lectures, illustration, demonstration	2h
7. Arithmetic coding <ul style="list-style-type: none"> • Information content and probability coding 	Lectures, illustration, demonstration	2h
8. Application of probability coding <ul style="list-style-type: none"> • Run-length Coding 	Lectures, illustration, demonstration	2h
9. Move-to-Front coding	Lectures, illustration, demonstration	2h
10. Lempel-Ziv algorithms: LZ77, LZ78	Lectures, illustration, demonstration	2h
11. Burrows Wheeler algorithm	Lectures, illustration, demonstration	2h
12. A case Study: JPEG vs MPEG	Lectures, illustration, demonstration	2h
13. Lossy Compression Techniques:	Lectures, illustration,	2h

<ul style="list-style-type: none"> • Scalar Quantization • Vector Quantization 	demonstration	
Final examination		2h
Recommended bibliography / Bibliografie <ul style="list-style-type: none"> • Thomas M. Cover, Joy A. Thomas. <i>Elements of information theory</i> New York: Wiley, 1991. ISBN 0-471-06259-6 • E. Shannon: A mathematical theory of communication. Bell System Technical Journal, 1948 • Data Compression, complete reference, David SOLOMON • Introduction to Data Compression, Guy E. <u>Blelloch</u> (short) • The Data Compression Book, Mark Nelson and Jean-loup Gailly • Principles of Digital Communication, ROBERT G. <u>GALLAGER</u> (coding) • Elements of Information Theory, Thomas M. Cover and Joy A. <u>thomas</u> • Information Theory, Inference, and Learning Algorithms, David J.C. <u>MacKay</u> 		
8.2. Seminar, lab / Seminar, laborator	Teaching/learning strategies / Metode de predare/ învățare	Remarks, details / Observații
1. Problems with frequencies, Hamming Codes	Problem solving, questioning, dialogue	2h
2. Problems with Entropy and related properties	Problem solving, questioning, dialogue	2h
3. Optimal codes and Huffman coding implementation	Problem solving, questioning, dialogue	2h
4. Optimality of Huffman Codes, Shannon–Fano–Elias Coding computation	Problem solving, questioning, dialogue	2h
5. Aritmetic encoding applications and implementation	Problem solving, questioning, dialogue	2h
6. Run-length and Move-to-front algorithms implementation	Problem solving, questioning, dialogue	2h
7. Lempel-Ziv implementation algorithms	Problem solving, questioning, dialogue	2h
Recommended bibliography / Bibliografie Thomas M. Cover, Joy A. Thomas. <i>Elements of information theory</i> New York: Wiley, 1991. ISBN 0-471-		

[06259-6](#)

David Solomon. [Data Compression: The Complete Reference](#), Volumul 10

Introduction to Data Compression, Guy E. Blelloch (short)

The Data Compression Book, Mark Nelson and Jean-loup Gailly

Principles of Digital Communication, ROBERT G. [GALLAGER](#) (coding)

9. Correlations between the content of the course and the requirements of the IT field / Coroborarea conținuturilor disciplinei cu așteptările reprezentanților comunității epistemice, asociațiilor profesionale și angajatorilor reprezentativi din domeniul aferent programului

10. Evaluation / Evaluare*

Activity / Tip de activitate	10.1. Evaluation criteria / Criterii de evaluare**	10.2. Evaluation methods / Metode de evaluare***	10.3. Weight in the averaged mark / Pondere din nota finală
10.4. Lecture / Curs	Theoretical final examination	answers to examination problems	20%
	Continous theoretical examination	answers to examination quiz problems	30%
10.5. Seminar/ lab			
	Final laboratory examination	final answers to practical laboratory tests	20%
	Projects		30%
10.6. Minimal knowledge for passing / Standard minim de performanță			
Understanding the terminology from Information Theory. Computes different entropy rates. Detect the codewords of a code source.			

Date/ Data completării
20.09.2020

Signature (lecture) /
Semnătura titularului de curs

Signature (seminar)
Semnătura titularului de seminar

Signature (director of the department)
Semnătura directorului de departament