The Hashemite University

الجامعـــــــة الهاشميــــــــة

**Deanship of Academic Development
and International Outreach**

عمادة التطوير الأكاديمي

والتواصل الدولي

Syllabus*: Theory of Computation and Code (151001240)
Second Semester 2022 /2021.

COURSE INFORMATION

Course Name: Theory of Computation **Semester:** Second **Department:** Department of Computer Science **Faculty:** Faculty of Prince Al-Hussein bin Abdullah II of Information Technology	**Course Code:** 151001460 **Section:** 1 and 2 **Core Curriculum**: Mandatory
Day(s) and Time(s): Sunday, Tuesday and Thursday 9:00-10:00 and 10:00-11:00 **Classroom:** IT 303 IT 201	**Credit Hours:** 3 **Prerequisites**: Discrete Mathematics (110101152)

COURSE DESCRIPTION

The goal of this course is to begin to understand the foundations of computation. Various models of computation exist, all of which capture some fundamental aspect of computation. We will concentrate on three classes of models: models with finite amount of memory (finite-state automata); models with stack memory (push-down automata); and unrestricted models (Turing machines). The notion of a formal grammar arises from the need to formalize the informal notions of grammar and language. Many formal grammars were invented: right-linear grammars, context-free grammars and unrestricted grammars. These grammars can be placed in a natural hierarchy. Surprisingly, there is a deep connection between these grammars, the strings they generate (their language), and the models of computation introduced above. This course will also briefly cover the impact of formal language theory for many computer science applications: in compilers, natural language processing, and program verification.

DELIVERY METHODS

The course will be delivered through an active classroom based discussion using Power point slides, Videos, and group discussion.

The whole material is uploaded on Moodle and the quizzes are held inside the class room using Moodle.

NOTE!!! If there is any cancellation on formal announced schedule the lecture will be given Online through Microsoft teams.

FACULTY INFORMATION

Name	**Ebaa Fayyoumi**
Academic Title:	**Associate Professor**
Office Location:	**IT 325**

Telephone Number:	**+962 5 390 3333 ex. 309**
Email Address:	**enfayyoumi@hu.edu.jo**
Office Hours:	**Sunday, Tuesday and Thursday** 12:00-13:00 *Please send an e-mail (enfayyoumi@hu.edu.jo) to meet at any other time.* *The Microsoft teams is active for all my classes. They may chat me and call me at any time we previously agree about it.*

REFERENCES AND LEARNING RESOURCES

Required Textbook

1. Introduction to the Theory of Computation, Michael Sipser, Thomson Course Technnology, Boston, Third edition, 2013.
2. Introduction to Languages and the Theory of Computation, John Martin, McGraw-Hill, Second edition, 2003.

Additional Reading

1. Introduction to Automata Theory, Languages, and Computation, John Hopcroft, Rajeev Motwani, Jeffrey Ullman, Addison Wesley, Third edition, 2007.
2. An Introduction to Formal Languages and Automata, Peter Linz, Jones and Bartlett publishers, Third edition, 2001.
3. Elements of the Theory of Computation, Harry Lewis and Christos Papadimitriou, Prentice-Hall, Second edition, 1998.

STUDENT LEARNING OUTCOMES MATRIX*

Core Curriculum Learning Outcomes	Program Learning Outcomes	Course Objectives	Course Student Learning Outcomes	Assessment Method
	CS SLOs SLO#1 Analyze a complex computing problem and to apply principles of computing and other relevant disciplines to identify solutions. SLO#2 Design, implement, and evaluate a computing-based solution to meet a given set of	Understand the foundations models with finite amount of memory (finite-state automata).	SLO#1 and SLO#2	Quiz and Exam
		Understand the foundations models with stack memory (push-down automata).	SLO#1 and SLO#2	Quiz and Exam
		Understand the foundation of unrestricted models (Turing machines).	SLO#1 and SLO#2	Quiz and Exam

	computing requirements in the content of the programs discipline. SLO#3 Communicate effectively in a variety of professional contexts. SLO#4 Recognize professional responsibilities and make informed judgments in computing practice based on legal and ethical principles. SLO#5 Function effectively as a member or leader of a team engaged in activities appropriate to the programs discipline. SLO#6 Apply computer science theory and software development fundamentals to produce computing-based solutions [CS].	Ability to use the informal notions of grammar and language. Ability to discuss/explain the importance of many formal grammars: right-linear grammars, context-free grammars and unrestricted grammars. Understand the impact of formal language theory for many computer science applications.	SLO#1 and SLO#4 SLO#4 and SLO#6 SLO#4 and SLO#6	Quiz and Exam Quiz and Exam Quiz and Exam

ACADEMIC SUPPORT

It is The Hashemite University policy to provide educational opportunities that ensure fair, appropriate and reasonable accommodation to students who have disabilities that may affect their ability to participate in course activities or meet course requirements. Students with disabilities are encouraged to contact their Instructor to ensure that their individual needs are met. The University through its Special Need section will exert all efforts to accommodate for individual's needs.
Special Needs Section:
Tel:
Location:
Email:

COURSE REGULATIONS

Participation
Class participation and attendance are important elements of every student's learning experience at The Hashemite University, and the student is expected to attend all classes. A student should not miss more than 15% of the classes during a semester. *Those exceeding this limit of 15% will receive a failing grade regardless of their performance*. It is a student's responsibility to monitor the frequency of their own absences. **Attendance record begins on the first day of class irrespective of the period allotted to drop/add and late registration. It is a student's responsibility to sign-in; failure to do so will result in a non-attendance being recorded.**

In exceptional cases, the student, with the instructor's prior permission, could be exempted from attending a class provided that the number of such occasions does not exceed the limit allowed by the University. The instructor will determine the acceptability of an absence for being absent. A student who misses more than 25% of classes and has a valid excuse for being absent will be allowed to withdraw from the course.

Plagiarism
Plagiarism is considered a serious academic offence and can result in your work losing marks or being failed. HU expects its students to adopt and abide by the highest standards of conduct in their interaction with their professors, peers, and the wider University community. As such, a student is expected not to engage in behaviours that compromise his/her own integrity as well as that of the Hashemite University.

Plagiarism includes the following examples and it applies to all student assignments or submitted work:

- **Use of the work, ideas, images or words of someone else without his/her permission or reference to them.**
- **Use of someone else's wording, name, phrase, sentence, paragraph or essay without using quotation marks.**
- **Misrepresentation of the sources that were used.**

The instructor has the right to fail the coursework or deduct marks where plagiarism is detected

Late or Missed Assignments

In all cases of assessment, students who fails to attend an exam, class project or deliver a presentation on the scheduled date without prior permission, and/or are unable to provide a medical note, will automatically receive a fail grade for this part of the assessment.

- Submitting a term paper on time is a key part of the assessment process. Students who fail to submit their work by the deadline specified will automatically receive a 10% penalty. Assignments handed in more than 24 hours late will receive a further 10% penalty. Each subsequent 24 hours will result in a further 10% penalty.
- In cases where a student misses an assessment on account of a medical reason or with prior permission; in line with University regulations an incomplete grade for the specific assessment will be awarded and an alternative assessment or extension can be arranged.

Student Complaints Policy

Students at The Hashemite University have the right to pursue complaints related to faculty, staff, and other students. The nature of the complaints may be either academic or non-academic. For more information about the policy and processes related to this policy, you may refer to the students' handbook.

COURSE ASSESSMENT

Course Calendar and Assessment

Students will be graded through the following means of assessment and their final grade will be calculated from the forms of assessment as listed below with their grade weighting taken into account. The criteria for grading are listed at the end of the syllabus

Assessment	Grade Weighting	Deadline Assessment
First Exam	20%	April 7th, 2022
Second Exam	20%	May 12th, 2022
Quizzes	20%	There are 4 quizzes
e.g. Final Exam (3)	40%	TBA

Description of Exams

Test questions will predominately come from material presented in the lectures. Semester exams will be conducted during the regularly scheduled lecture period. Exam will consist of a combination of multiple choice, short answer, match, true and false and/or descriptive questions.

Letter Grade	Description	Grade Points
A+	Excellent	4.00
A		3.75
A-		3.50
B+	Very Good	3.25
B		3.00
B-		2.75
C+	Good	2.50
C		2.25
C-		2.00
D+	Pass	1.75
D	Pass	1.50
F	Fail	0.00
I	Incomplete	-

WEEKLY LECTURE SCHEDULE AND CONTENT DISTRIBUTION

Chapter 1	*Introduction (Spiser Book)*	Week 1	3 lecture hours
1.1	What is Theory of Computation		
2.1	Areas of Theory of Computation		
Chapter 1	Mathematical Tools and Techniques	Week 2/3	6 lecture hours
1.1	Logic and Proofs		
1.2	Sets		
1.3	Functions and Equivalence Relations		
1.4	Languages		
1.5	Structural Induction		
Chapter 2	Finite Automata and The Languages They Accept	Week 4/5	6 lecture hours
2. 1. 1	Finite Automata: Examples and Definitions		
2. 1. 2	Design Several DFA machines		
2. 1. 3	Extended Transitivity		
2.2	Accepting Union, Intersection or Difference of two Languages		
Chapter 3	Regular Expressions, Non-determinism	Week 6	2 lecture hours
3.1	Regular Language and Regular Expression		
	First Exam		
Chapter 3	Regular Expressions, Non-determinism	Week 7/8	5 Lecture hours
3. 2. 1	Non Deterministic Finite Automata: Examples and Definitions		
3. 2. 2	Design Several NDFA machines		
3. 2. 3	Extended Transitivity		
3. 2. 4	Computational Tree		
Chapter 2	Finite Automata and The Languages They Accept	Week 8/9/10	7 lecture hours
2. 3	Distinguishing one string from another,		
2. 5	How to build a Simple Computer Using Equivalence Classes		

2. 4	**The Pumping Lemma**		
2. 6	**Minimizing the Number of States in a finite Automaton.**		
Chapter 3	**Regular Expressions, Non-determinism**	**Week 11**	**3 lecture hours**
3.3	**The Nondeterminisim in an NFA can be eliminate**		
3.4	**Convert NDFA to DFA**		
3. 5	**Kleene's Theorem, Part1 and Part2.**		
Chapter 4	***Context –Free Languages***	**Week 12/13**	**6 Lecture hours**
4.1	**Using Grammar Rules to Define a Language**		
4.2	**Context-Free Grammar: Definitions**		
4.3	**Context-Free Grammar: Examples**		
	Second Exam		
4.5	**Regular Languages and Regular Grammars**		
4.6	**Derivation Trees and Ambiguity**		
4.7	**Simplified Forms and Normal Forms.**		
Chapter 5	**Pushdown Automata**	**Week 14**	**3 lecture hours**
5.1	**Pushdown Automata Definitions**		
5.2	**Pushdown Automata Examples**		
5.3	**Deterministic Pushdown Automata**		
5.4	**A PDA from a Given CFG**		
5.5	**A CFG from a Given PDA. Parsing**		
Review		**W*eek 15***	
	Final Exam		