

# Theory of Computing:

## *Syllabus*



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# Outline :

- Aims and Objectives
- Course Content
- Why it is important
- Teaching Staff
- Evaluation & Assignments
- Resources
- Ethics & Policies.





# Aims & Objectives

- The aim of this module is to provide the basic concepts for the theory of computation and complexity.
- Students will learn
  - What can be computed and what cannot be computed at all
  - How efficiently can it be computed
  - How to formally reason about computation
  - The technology-independent foundations of computer science



# Course Content

- **Introduction**
  - Complexity theory, Computability theory, Mathematical notions, Types of Proofs
- **Automata theory**
  - Regular Languages : Finite Automata, Non-determinism, Regular Expressions, nonregular languages.
  - Context-free languages : Grammars, Pushdown automata
- **Computability theory**
  - Turing machines, recursively enumerable and recursive languages
  - Church-Turing thesis
  - Decidability
  - Reducibility
- **Complexity Theory**
  - Complexity of algorithms and of problems
  - Complexity classes P, NP, PSPACE
  - Polynomial-time reduction
  - NP-Completeness and Cook's theorem + PSPACE-Completeness



# Why it is important ?

- Are we going to teach you programming ?
- Or how to create beautiful looking software systems ?
- Or how to create a computer ?
- Or how to create a smart AI solution ?



# Why it is important ?

- Improve your skills for problem solving and algorithmic thinking
- Learn how to solve problems efficiently
- Master the formalism to creating solutions for a given problem using abstract models.
- Considered among the most fundamental courses for computer science. (Based on a survey for Stanford graduates)

# Teaching Staff



- **Professor Imed Bouchrika**

*imed.bouchrika@ensia.edu.dz*

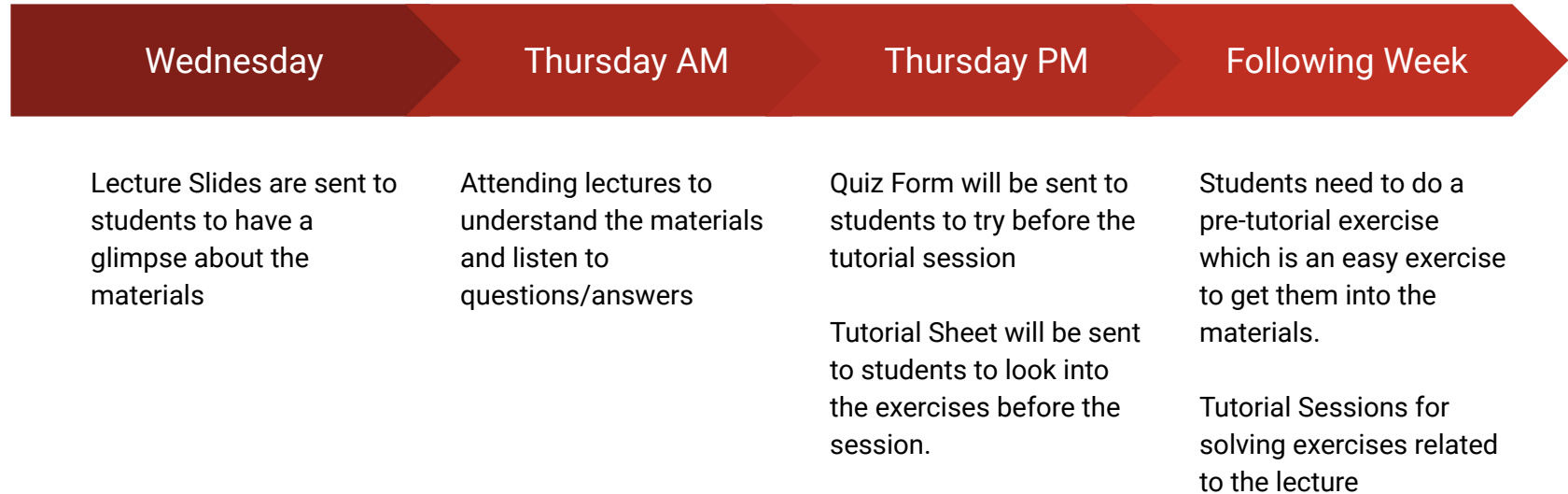
*Office Hours :*

- **Dr. Farah Ibelaiden**

*farah.ibelaiden@ensia.edu.dz*

*Office Hours :*

# Learning Process







# Evaluation & Assignments

- Exam : 60%
- Continuous Evaluation : 40%
  - Tutorial Online Quiz : **5 points** : ( **from 10 quizzes** )
  - Mid-Term Exam : **10 points** ( *8th Week* )
  - Assignment/Homework : **3 points**
  - Staff Appreciation : **2 points**
    - Challenge Exercises : **3 points** (Optional)
    - Penalty of Non-Justified Absence : **-5 points**
- Late Submission :
  - 1 day Penalty of 20%
  - 2 days Penalty of 50%
  - 3 days → Zero mark is given.



# Quizzes (5 points)

- Quiz will be available either :
  - After the lecture and closed on the same day
  - During the lecture only.
- Quizzes are intended for people who attend the lecture, If you miss the lecture, your quiz submission will not be considered ( Exception to student who have a valid justification).
- Missing three quizzes, zero mark will be given directly and all other submissions will not be considered.



# Quizzes (5 points)

- Online Quizzes should preferably be done before attending the tutorial sessions.
- Quizzes include easy/medium M.C.Questions aimed to enforce your understanding for the concepts discussed during the lecture.
- PLEASE : Don't rush to answer the quiz, take your time, **search for the solutions on the web** and submit your answers when you are certain.
- The quiz will be open only for a limited time. ( To ensure students will not procrastinate doing their revision and homework)



# Assignments (3 points)

- There would be an exercise(s) given as an assignment from time to time
- Submission of your solution should be done through the Google Classroom platform OR Reviewed by the tutorial staff in the following week.
- Late submission subjected to the agreed penalties.
- Badly written, poorly phrased, unclear solution would be penalized. Typing your solution is recommended.
- The difficulty is medium for the exercises.

# Challenge Questions

## (3 points of extra credit)

- Meant for you to learn how to solve difficult problems that you may face in the future and you can not find their solutions on the web freely.
- Solutions for the challenge Exercises will be submitted via Google Classroom when the Assignments are created. **(It will be created without prior notice with only a one day deadline)**
- Solving the exercises is optional, but you are encouraged to do so.



# Attending Lectures

- There would be quizzes during lectures from time to time. They will be graded.
- Can the lectures be substituted by Youtube videos given by Top Scientists from MIT and Stanford ?
- Are lectures about telling you what's inside the book that you can read on your own ?
- Deliberate missing of lectures would contribute to create a lazy atmosphere among the students + Accumulation of pressure and stress before the exam.



# Absence & Coming late

- Tutorial Sessions :
  - Students being absent more than allowed, law will be strictly applied and students will be excluded.
- Absence Penalty Points :
  - **-0.5 Point per Non-Justified Absence** (Tutorial Sessions + Lectures)
  - tutorial session = one session of 90 minutes
  - A max of **5 points** can be deducted from the Continuous Mark.
  - Students being absent more than 5 times (Lecture/TD), will not be considered for the bonus points.
  - Table for Logging all absences :  
[https://docs.google.com/spreadsheets/d/1rJCO\\_iLFXZd82jv2nwfW58tvcoBKOSdE2Vkm6\\_pFOvw/edit#gid=956790473](https://docs.google.com/spreadsheets/d/1rJCO_iLFXZd82jv2nwfW58tvcoBKOSdE2Vkm6_pFOvw/edit#gid=956790473)
- Being late :
  - Students coming 10 minutes late, will be allowed in class but they will be considered **ABSENT**



# Tutorial Sessions - TD

- Exercises of Prefix :
  - **C** : to be solved in class where you will be given some time to try to solve them.
  - **A : Assignments/homework** that you need to solve within a week deadline. You need to submit your solution via Google Classroom
  - **P** : Are optional exercises to be done at home after class. Discuss with your colleagues about the possible solutions. Feel free to bring your solutions to the tutorial staff to discuss in class when convenient.
- Note that all **P exercises** are potential exam questions that they **will** be included into the midterm/final exams.





# Resources

- Course Textbook :  
*Michael Sipser. Introduction to the Theory of Computation. 3rd Edition. 2012*
- Materials from other universities:
  - Stanford University : <http://infolab.stanford.edu/~ullman/ialc/spr10/spr10.html>
  - University of Boston : [https://cs-people.bu.edu/mbun/courses/332\\_F21/](https://cs-people.bu.edu/mbun/courses/332_F21/)
  - Washington State University : <https://eecs.wsu.edu/~ananth/CptS317/Lectures/index.htm>
  - University of California, San Diego : <https://cseweb.ucsd.edu/classes/wi09/cse105/>
  - University of Illinois : <https://courses.engr.illinois.edu/cs373/sp2010/lectures/>



# Resources

- Youtube Video Lectures:

- Stanford University :

<https://www.youtube.com/watch?v=U7LrP3s5tKU&list=PLoCMsyE1cVdV4CkdIZRKW8lk2BBOW-fbF&index=2>

- MIT ( Sipser ) :

[https://www.youtube.com/watch?v=gsyvZr-gxwk&list=PLUl4u3cNGP6o\\_JNv2MmK3wkOt9syvfQWY](https://www.youtube.com/watch?v=gsyvZr-gxwk&list=PLUl4u3cNGP6o_JNv2MmK3wkOt9syvfQWY)

- Neso Academy :

<https://www.youtube.com/watch?v=58N2N7zJGrQ&list=PLBlnK6fEyqRgp46KUv4ZY6gyXmpwKOlev>



# Policies

- All homework must be done individually
- Students caught cheating will be given a zero mark. Cheating includes the case of helping others, getting help, looking up websites for solutions with a direct copy & paste...(Exception is made for the quiz)
- The use of Mobile Phones inside the classroom is **prohibited**. Disciplinary measures would be taken as it is considered as a disrespect to the lecturers whilst they are teaching.
- ChatGPT is totally forbidden for learning. You will be penalized ( Points deducted) if you are found to use ChatGPT.