Birla Institute of Technology & Science, Pilani
K. K. Birla Goa Campus
First Semester 2020-2021
Course Handout (Part-II)

In addition to part I this portion gives further specific details regarding the course Logic in Computer Science.

Course Details

Course Title	:	Logic in Computer Science
Course Number	:	CSF214
Instructor-In-charge	:	A Baskar

Scope and Objective

Logic is the study of inference and argument. In particular it helps us to differentiate between correct and faulty reasonings. In this course we see two mathematical models to understand the reasoning we use in our daily lives. The first model, propositional logic, focuses on the connectives which are useful to build compound statements from atomic statements. The model is very simple and inadequate to discuss most of the inferences we use. Nevertheless it lays a foundation for more sophisticated models: coming up with good definitions and identifying questions we are concerned from the computer science perspective. The second model, first order logic, is suitable enough to express deductions in Mathematics. The emphasis here is on quantification: what do "for all" and "there exists" mean? We address similar questions encountered in propositional logic but in the context of first order logic. At the end of the course, we will see an application (using logic to develop a theoretical framework to check program correctness) and fragment of first order logic (Linear temporal logic) which was quite useful in practice.

Text book

(T_1) Mathematical Logic for Computer Science by Mordechai Ben-Ari, Second Edition

Please note that whatever definitions, notations and techniques which we use in the class are final.

References

(R_1) A Beginner's Guide to Mathematical Logic by Raymond Smullyan

(R_2) Logic for Computer Scientists, Uwe Schöning

(R_3) A Mathematical Introduction to Logic by Herbert B. Enderton

Course Plan

Modules

Module No	Topic	Objectives
	Introduction	Introducing goals and historical background of Logic.
I	Propositional Logic	Student should be able to explain the algorithmic problems in propositional logic and analyze various algorithms for these problem. Student should be able to translate some real world situations using propositional logic.
II	First Order Logic	Student should be able translate some real world situations using FOL and investigate the complexity of algorithmic problems in FOL.
III	Applications of Logic	Student should be able to check program correctness.
IV	Temporal Logic	Student should be able to express temporal properties using LTL and compare the efficiency of LTL with other logics.

Lecture Schedule

Lecture	Topics	Reading	Module No
1	Introduction to Logic		
2–6	Propositional Logic: Syntax	T_1 Chapter 2	I
6–9	Propositional Logic: Semantics	T_1 Chapter 2	I
10–12	Propositional Logic: Semantic Tableau	T_1 Chapter 2	I
13–15	Applications of Proposition Logic: SAT solvers		I
16–18	Deductive Systems: Resolution	T_1 Chapter 4	I
25–27	First Order Logic: Syntax	T_1 Chapter 5	II
28–30	First Order Logic: Semantics	T_1 Chapter 5	II
31–33	First Order Logic: Resolution	T_1 Chapter 7	II
34–36	Program Verification	T_1 Chapter 9	III
37–39	Linear Time Temporal Logic and its applications	T_1 Chapter 11	IV
40	Summary and Review		

Evaluation Scheme

No	Component	Weightage	Date	Time	Remarks
1	Test 1	12%	15/9/2020	8 AM – 9 AM	Partly Open Book
2	Test 2 1	15%	20/10/2020	8 AM – 9 AM	Partly Open Book
3	Test 3 1	13%	10/11/2020	8 AM – 9 AM	Partly Open Book
4	Comprehensive	35%	05/12/2020	2 PM – 5 PM	Partly Open Book
5	Quiz	10%	-	-	Online
4	Assignment	15%	-	-	Open Book

Consultation

Monday(12.00 – 1.30 PM). Please use google calendar to get an appointment slot.

Notices

The course site on Google Classroom will be used and some announcements will be made in the class during lectures.

Make-up Policy

- There are no make-ups for quizzes and assignment under any circumstances. If we conduct n quizzes, we will take the best n-1 quizzes for grading. If we have n assignments, we will take the best n-1 assignments for grading.
- For other components, make-up shall be granted only in genuine cases based on individual's need and circumstances.
- No marks will be awarded without make-up for that component.

Instructor-In-Charge
CSF214