NORTHWESTERN POLYTECHNIC

DEPARTMENT of Science

COURSE OUTLINE – Winter 2025

CS2720 A3, S1, S2, L1, L2: Formal Systems and Logic in Computing Science – 3 (3-1-1.5) 82.5 Hours for 15 Weeks

Northwestern Polytechnic acknowledges that our campuses are located on Treaty 8 territory, the ancestral and present-day home to many diverse First Nations, Metis, and Inuit people. We are grateful to work, live and learn on the traditional territory of Duncan's First Nation, Horse Lake First Nation and Sturgeon Lake Cree Nation, who are the original caretakers of this land.

We acknowledge the history of this land and we are thankful for the opportunity to walk together in friendship, where we will encourage and promote positive change for present and future generations.

INSTRUCTOR: Brian Redmond
OFFICE: J206
OFFICE HOURS: MW 10:00 AM - 11:30 AM (or by appointment)

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CALENDAR DESCRIPTION:

An introductory course to present the tools of set theory, logic and induction, and their use in the practice of reasoning about algorithms and programs. Basic set theory. The notion of a function. Counting. Propositional and predicate logic and their proof system will be studied. Inductive definitions and proofs by induction will be covered along with program specification and correctness.

PREREQUISITE:

CS1140 – Introduction to Computing Science

RECOMMENDED TEXT/RESOURCE MATERIALS:

- Applied Discrete Structures (Doerr & Levasseur)
- Use of calculators is not permitted on the tests or exams.
- SageMath

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DELIVERY MODE(S):

Lectures:	Tuesdays (A3) and Thursdays (A3)	8:30 AM – 9:50 AM	E303
Seminars:	Wednesdays (S2) and Fridays (S1)	4:00 PM – 4:50 PM	G111
Labs:	Wednesdays (L2) and Fridays (L1)	2:30 PM – 3:50 PM	G111

LEARNING OUTCOMES:

By the end of this course, students will be able to:

- Work with sets, subsets, power sets, Cartesian products, and equivalence relations.
- Understand functions and apply counting principles such as permutations, combinations, the Pigeonhole Principle, and the Principle of Inclusion-Exclusion.
- Analyze sequences, formulate and solve recurrence relations to model algorithms.
- Construct and analyze logical statements using propositions, predicates, and quantifiers, and apply proof techniques such as induction, contradiction, and contrapositive.
- Use Boolean algebra and Karnaugh maps to simplify logical expressions and design circuits.
- Perform modular arithmetic and apply it to cryptography, hashing, and other computer science applications.
- Convert between binary, decimal, octal, and hexadecimal number systems, and explain integer representation in computing, including signed and unsigned formats.
- Specify, analyze, and prove the correctness of algorithms using logical reasoning and formal methods.
- Implement solutions to mathematical and algorithmic problems using SageMath and Python.

TRANSFERABILITY:

Please consult the Alberta Transfer Guide for more information. You may check to ensure the transferability of this course at the Alberta Transfer Guide main page http://www.transferalberta.alberta.ca.

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** Grade of D or D+ may not be acceptable for transfer to other post-secondary institutions. **Students are cautioned that it is their responsibility to contact the receiving institutions to ensure transferability.**

EVALUATIONS:

Worksheets	15%
Labs	15%
Midterm	25%
Final	45%

GRADING CRITERIA:

Please note that most universities will not accept your course for transfer credit **IF** your grade is **less than C-**.

Alpha Grade	4-point Equivalent	Percentage Guidelines	Alpha Grade	4-point Equivalent	Percentage Guidelines
A+	4.0	95-100	C+	2.3	67-69
A	4.0	85-94	C	2.0	63-66
A-	3.7	80-84	C-	1.7	60-62
B+	3.3	77-79	D+	1.3	55-59
B	3.0	73-76	D	1.0	50-54
B-	2.7	70-72	F	0.0	00-49

COURSE SCHEDULE/TENTATIVE TIMELINE:

Lecture/Seminar/Lab	Date	Topic	Notes
Lec1	Tues. Jan. 7	Set Theory	
L1/S1	Wed. Jan. 8		LAB#0
Lec2	Thurs. Jan. 9		WORKSHEET#0
L1/S1	Fri. Jan. 10		LAB#0
Lec3	Tues. Jan. 14		
L2/S2	Wed. Jan. 15		LAB #1

Lec4	Thurs. Jan. 16		WORKSHEET#1
L2/S2	Fri. Jan. 17		LAB #1
Lec5	Tues. Jan. 21	Functions and Relations	
L3/S3	Wed. Jan. 22		LAB #2
Lec6	Thurs. Jan. 23		WORKSHEET#2
L3/S3	Fri. Jan. 24		LAB #2
Lec7	Tues. Jan. 28		
L4/S4	Wed. Jan. 29		LAB #3
Lec8	Thurs. Jan. 30		WORKSHEET#3
L4/S4	Fri. Jan. 31		LAB #3
Lec9	Tues. Feb. 4	Combinatorics	
L5/S5	Wed. Feb. 5		LAB #4
Lec10	Thurs. Feb. 6		WORKSHEET#4
L5/S5	Fri. Feb. 7		LAB #4
Lec11	Tues. Feb. 11		
L6/S6	Wed. Feb. 12		LAB #5
Lec12	Thurs. Feb. 13		WORKSHEET#5
L6/S6	Fri. Feb. 14		LAB #5
	Tues. Feb. 18	Winter Break – no classes	
	Wed. Feb. 19		
	Thurs. Feb. 20		
	Fri. Feb. 21		
Lec13	Tues. Feb. 25		Midterm
L7/S7	Wed. Feb. 26	Logic and Induction	
Lec14	Thurs. Feb. 27		
L7/S7	Fri. Feb. 28		
Lec15	Tues. Mar. 4		

L8/S8	Wed. Mar. 5		LAB #6
Lec16	Thurs. Mar. 6		WORKSHEET#6
L8/S8	Fri. Mar. 7		LAB #6
Lec17	Tues. Mar. 11		
L9/S9	Wed. Mar. 12		LAB #7
Lec18	Thurs. Mar. 13		WORKSHEET#7
L9/S9	Fri. Mar. 14		LAB #7 (Pi Day!!)
Lec19	Tues. Mar. 18	Boolean Algebra	
L10/S10	Wed. Mar. 19		LAB #8
Lec20	Thurs. Mar. 20		WORKSHEET#8
L10/S10	Fri. Mar. 21		LAB #8
Lec20	Tues. Mar. 25	Recursion and Recurrence Relations	
L11/S11	Wed. Mar. 26		LAB #9
Lec21	Thurs. Mar. 27		WORKSHEET#9
L11/S11	Fri. Mar. 28		LAB #9
Lec22	Tues. Apr. 1	Program Specification and Correctness	
L12/S12	Wed. Apr. 2		LAB #10
Lec23	Thurs. Apr. 3		WORKSHEET#10
L12/S12	Fri. Apr. 4		LAB #10
Lec24	Tues. Apr. 8	Review	
L13/S13	Wed. Apr. 9		
Lec25	Thurs. Apr. 10		
L13/S13	Fri. Apr. 11		

Final exam period: Monday, April 14 – Wednesday, April 23, inclusive.

STUDENT RESPONSIBILITIES:

This is a challenging course. Success requires regular attendance, timely completion of assignments, and at least 10 hours of weekly study outside of class. Collaboration

with classmates is encouraged, but each student must submit their own work and ensure they understand it fully.

STATEMENT ON ACADEMIC MISCONDUCT:

Academic Misconduct will not be tolerated. For a more precise definition of academic misconduct and its consequences, refer to the Student Rights and Responsibilities policy available at https://www.nwpolytech.ca/about/administration/policies/index.html.

**Note: all Academic and Administrative policies are available on the same page.