

Faculty of Engineering and Computer Science Expectations of Originality

This form sets out the requirements for originality for work submitted by students in the Faculty of Engineering and Computer Science. Submissions such as assignments, lab reports, project reports, computer programs and take-home exams must conform to the requirements stated on this form and to the Academic Code of Conduct. The course outline may stipulate additional requirements for the course.

1. Your submissions must be your own original work. Group submissions must be the original work of the students in the group.
2. Direct quotations must not exceed 5% of the content of a report, must be enclosed in quotation marks, and must be attributed to the source by a numerical reference citation¹. Note that engineering reports rarely contain direct quotations.
3. Material paraphrased or taken from a source must be attributed to the source by a numerical reference citation.
4. Text that is inserted from a web site must be enclosed in quotation marks and attributed to the web site by numerical reference citation.
5. Drawings, diagrams, photos, maps or other visual material taken from a source must be attributed to that source by a numerical reference citation.
6. No part of any assignment, lab report or project report submitted for this course can be submitted for any other course.
7. In preparing your submissions, the work of other past or present students cannot be consulted, used, copied, paraphrased or relied upon in any manner whatsoever.
8. Your submissions must consist entirely of your own or your group's ideas, observations, calculations, information and conclusions, except for statements attributed to sources by numerical citation.
9. Your submissions cannot be edited or revised by any other student.
10. For lab reports, the data must be obtained from your own or your lab group's experimental work.
11. For software, the code must be composed by you or by the group submitting the work, except for code that is attributed to its sources by numerical reference.

You must write one of the following statements on each piece of work that you submit:

For individual work: **“I certify that this submission is my original work and meets the Faculty's Expectations of Originality”**, with your signature, I.D. #, and the date.

For group work: **“We certify that this submission is the original work of members of the group and meets the Faculty's Expectations of Originality”**, with the signatures and I.D. #s of all the team members and the date.

A signed copy of this form must be submitted to the instructor at the beginning of the semester in each course.

I certify that I have read the requirements set out on this form, and that I am aware of these requirements. I certify that all the work I will submit for this course will comply with these requirements and with additional requirements stated in the course outline.

Course Number: _____
Name: _____
Signature: _____

Instructor: _____
I.D. # _____
Date: _____

¹ Rules for reference citation can be found in “Form and Style” by Patrich MacDonagh and Jack Bordan, fourth edition, May, 2000, available at <http://www.encs.concordia.ca/scs/Forms/Form&Style.pdf>.

DEPARTMENT OF COMPUTER SCIENCE & SOFTWARE ENGINEERING
COMP232 MATHEMATICS FOR COMPUTER SCIENCE
FALL 2018

Assignment 1. Due date: Thursday September 27

1. For each of the following statements use a truth table to determine whether it is a tautology, a contradiction, or a contingency.

(a) $((p \vee r) \wedge (q \vee r)) \leftrightarrow ((p \wedge q) \vee r)$

(b) $(p \oplus q) \wedge (p \oplus \neg q)$

(c) $(p \rightarrow (q \rightarrow r)) \leftrightarrow (p \rightarrow (q \wedge r))$

(d) $(p \wedge (\neg q \rightarrow \neg p)) \rightarrow q$

2. For each of the following logical equivalences state whether it is valid or invalid. If invalid then give a counterexample (*e.g.*, based on a truth assignment). If valid then give an algebraic proof using logical equivalences from Tables 6, 7, and 8 from Section 1.3 of textbook.

(a) $(p \rightarrow r) \wedge (q \rightarrow r) \equiv (p \wedge q) \rightarrow r$

(b) $(p \rightarrow q) \vee (p \rightarrow r) \equiv (p \vee q) \rightarrow r$

(c) $((p \vee q) \wedge (p \rightarrow r) \wedge (q \rightarrow r)) \rightarrow r \equiv T$

(d) $((p \rightarrow q) \wedge (q \rightarrow r)) \rightarrow (p \rightarrow r) \equiv T$

3. Which of the following conditions are *necessary*, and which conditions are *sufficient* for the natural number n to be divisible by 6. The natural numbers are $\mathbb{N} = \{0, 1, 2, \dots\}$.

(a) n is divisible by 3.

(b) n is divisible by 9.

(c) n is divisible by 12.

(d) $n = 24$

(e) n^2 is divisible by 3.

(f) n is even and divisible by 3.

4. A set of propositions is *consistent* if there is an assignment of truth values to each of the variables in the propositions that makes each proposition true. Is the following set of propositions consistent?

If the file system is not locked, then new messages will be queued.

If the file system is not locked, then the system is functioning normally, and conversely.

If new messages are not queued, then they will be sent to the message buffer.

If the file system is not locked, then new messages will be sent to the message buffer.

New messages will not be sent to the message buffer.

5. Suppose the domain of the propositional function $P(x, y)$ consists of pairs x and y , where $x = 1, 2$, or 3 , and $y = 1, 2$, or 3 . Write out the propositions below using disjunctions and conjunctions only.

(a) $\exists x P(x, 3)$

(b) $\forall y \neg P(2, y)$

(c) $\forall x \exists y P(x, y)$

(d) $\exists x \forall y \neg P(x, y)$

6. Let the domain for x be the set of all students in this class and the domain for y be the set of all countries in the world. Let $P(x, y)$ denote “*student x has visited country y* ” and $Q(x, y)$ denote “*student x has a friend in country y* .” Express each of the following using logical operations and quantifiers, and the propositional functions $P(x, y)$ and $Q(x, y)$.

(a) *Carlos has visited Bulgaria.*

(b) *Every student in this class has visited the United States.*

(c) *Every student in this class has visited some country in the world.*

(d) *There is no country that every student in this class has visited.*

(e) *There are two students in this class, who between them, have a friend in every country in the world.*

(f) *Nobody in this class has visited a country in which they did not have a friend.*

7. For each part in the previous question, form the negation of the statement so that all negation symbols occur immediately in front of predicates. For example:

$$\neg(\forall x(P(x) \wedge Q(x))) \equiv \exists x(\neg((P(x) \wedge Q(x)))) \equiv \exists x((\neg P(x)) \vee (\neg Q(x)))$$

8. Negate the following statements and transform the negation so that negation symbols immediately precede predicates. (See example in Question 7.)

(a) $(\exists x \exists y P(x, y)) \vee (\forall x \forall y Q(x, y))$

(b) $\forall x \forall y (Q(x, y) \leftrightarrow Q(y, x))$

(c) $\forall y \exists x \exists z (T(x, y, z) \wedge Q(x, y))$