MAT1830 - Discrete Mathematics for Computer Science
Assignment #1
Submit by uploading a pdf to moodle by 11:55pm Wednesday in week 4

Assessment questions/solutions for this unit must not be posted on any website.

Show your working and give explanations for questions (1), (2) and (5)(ii). For questions (3), (4) and (5)(i) only answers are required.

(1) Give a truth table for $\big(\neg a \vee (a \to \neg b)\big) \leftrightarrow c$. State whether the sentence is a tautology, a contradiction or neither and briefly explain why. **[4]**

(2) Use laws of logic to show that $(p \wedge \neg q) \wedge \big(q \wedge (\neg q \to r)\big)$ is a contradiction. Explain each step fully. **[4]**

(3) Consider the statement "If $\gcd(x, 20) = 1$, then $\gcd(x, 2) = 1$ or $\gcd(x, 5) = 1$." In English (not using logical symbols), write down the statement's contrapositive and then write down the statement's negation. In the negation, you may not use "if", "then", "implies" or similar words. **[2]**

[No explanation required but no partial marks for incorrect answers.]

(4) Two cats, Felix and Sylvester, are fed every evening. On any given evening, each cat gets a medicated meal if it is sick and a normal meal otherwise. On weekends, both cats get treats as well as their meals. On weekdays, each cat gets treats as well as its meal if it has been well-behaved, but otherwise it does not get treats.

Let p be the proposition that the Felix is sick.

Let q be the proposition that the Sylvester is sick.

Let r be the proposition that the Felix has been well-behaved.

Let s be the proposition that the Sylvester has been well-behaved.

Let t be the proposition that it is a weekend.

Write down propositions (using just p, q, r, s, t, brackets and logical connectives) that are logically equivalent to the following statements.

(i) Felix gets treats.
(ii) Sylvester gets a normal meal without treats.
(iii) Exactly one of the two cats gets treats.

[No explanation required but no partial marks for incorrect answers.] **[6]**

(5) Let n be an integer such that $n \geq 3$. Suppose that a truth table is drawn for the logical sentence

$$(p_2 \vee p_3 \vee \cdots \vee p_n) \to p_1.$$

(i) If $n = 3$, then in how many rows would the sentence evaluate to true?
(ii) In general, in how many rows would the sentence evaluate to true? (Give your answer as a function of n.)

[No explanation required for (i). Give a brief explanation for (ii).] **[4]**