

HARD COPY due: Thursday 22 August 2019 at 2pm (sharp).

Follow the instructions *closely* when solving the problems in order to obtain full marks. Clearly label the solutions 1(a)(i) etc. **Use black/blue pen only.**

Fill in and sign the Cover Sheet attached, writing your **Tutor's** name in the row "*For attention of*", and **staple it** to your assignment.

HOBART: Submit your assignment in the drop box labelled 'KMA155/KIT103' with *your* Tutorial Group details on the box, located on Level 3 in the Physics Building. *Make sure to put your assignment in the correct box.*

LAUNCESTON: Submit your assignment in the drop box labelled 'KIT103', located next to the Help Desk in the Computing Building (Building V).

Extensions, Late submission penalties: Refer to the Unit Outline for the details.

Each of the questions 1, 2, ..., 6 is worth the same proportion of marks.

_____ QUESTIONS (1 – 6): _____

1. Consider the sentence P defined as follows:

$$\left(\exists n \in \mathbb{Z}^+\right) \left((n < 1) \vee (n > 11)\right).$$

- (a) First, state the negation of the sentence $(n < 1) \vee (n > 11)$.
 - (b) Next, state the negation P' of the sentence P .
 - (c) Further, determine the logical value of P . Give full details of your reasoning.
 - (d) Then, use the logical value of P to determine the logical value of P' (explain).
2. Give examples of sentences in natural language (English), about everyday topics, which have the forms:

- (a) $(P \wedge Q) \Rightarrow R$,
- (b) $P \Leftrightarrow (Q' \vee S)$.

In each case,

- (i) *first* state the sentence in natural language,
- (ii) and *then* define all sentences involved (e.g. P , Q , R , S).

3. Using a truth table, show that

$$(P \Leftrightarrow Q) \Leftrightarrow ((P \wedge Q) \vee (P' \wedge Q'))$$

is a tautology. Include *all* required columns. *Justify* the conclusion using words.

4. Using appropriate logical equivalences, show that (watch the brackets),

$$((P \wedge (P \Rightarrow Q)) \Rightarrow Q) \equiv \mathbf{T}$$

by starting with

$$((P \wedge (P \Rightarrow Q)) \Rightarrow Q) \equiv$$

and then transforming this appropriately, referencing a required logical equivalence at each step. Use *one* transformation (*one* logical equivalence) per step only.

5. Use a truth table to determine whether the following is a valid argument:

$$\begin{array}{l} P \vee Q \\ P' \vee R \\ R' \vee S \\ \therefore Q \vee S. \end{array}$$

State the answer and explain why.

6. *Using Mathematical Induction*, show that the sum of n consecutive odd positive integers is equal to n^2 . That is, show that

$$\sum_{k=1}^n (2k-1) = n^2$$

for all $n \in \mathbb{Z}^+$. Include *all* components of the proof by Mathematical Induction, as discussed in the lectures.

_____ THE END _____

Assignment Cover Sheet



OFFICE USE ONLY
Assignment received:

Assignment
Title/Number:
