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Family name Given name Student number

**ENS1161 Computer Fundamentals**

**Test 1**

(a) Use a truth table to show that ( p ∨ q ) ∨ ( ~ p ∧ ~ q) is a tautology.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **p** | **q** | p ∨ q | ~ p ∧ ~ q | ( p ∨ q ) ∨ ( ~ p ∧ ~ q) |
| 0 | 0 | 0 | 1 | 1 |
| 0 | 1 | 1 | 0 | 1 |
| 1 | 0 | 1 | 0 | 1 |
| 1 | 1 | 1 | 0 | 1 |

(b) Define the following propositions: r: room is dark

h: house is old

Write each of the following statements in symbols:

1. Either room is dark or house is not old.

r ∨ ~h

(ii) If room is not dark then house is not old.

~r → ~h

(c) Write the negation of each of the statements in part (b) in **simple** English:

(i) room is not dark and house is old

(ii) room is not dark and house is old

(d) Consider the following argument: ~q → (p ∨ ~r), r, ~p | q

Complete the truth table below. Hence decide whether the argument is valid and then justify your conclusion.

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | conc | pre |  |  |  | pre | pre | check |
| **p** | **q** | **r** | **~r** | **p ∨ ~r** | **~q** | **~q → (p ∨ ~r)** | **~p** |  |
| 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 |  |
| 0 | 0 | 1 | 0 | 0 | 1 | 0 | 1 |  |
| 0 | 1 | 0 | 1 | 1 | 0 | 1 | 1 |  |
| 0 | 1 | 1 | 0 | 0 | 0 | 1 | 1 | yes |
| 1 | 0 | 0 | 1 | 1 | 1 | 1 | 0 |  |
| 1 | 0 | 1 | 0 | 1 | 1 | 1 | 0 |  |
| 1 | 1 | 0 | 1 | 1 | 0 | 1 | 0 |  |
| 1 | 1 | 1 | 0 | 1 | 0 | 1 | 0 |  |

The argument is valid

Justification: Argument is valid because the only instance where premise **~q → (p ∨ ~r), r, ~p** are true, the conclusion **q** is also true.

[ 2 + 2 + 2 + 4 = 10 marks ]