

**COMP 3710 - 3**

**Applied Artificial Intelligence (3,1,0)**

**Fall 2017**

**Seminar/Lab 5.**

**Propositional logic, and genetic algorithm for TSP**

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1. (2 marks) Which of the followings are correct? You need to prove or disprove using truth tables.
   1. (*A* ∧ *B*) → *C* ≡ (*A* → *C*) ∨ (*B* → *C*)
   2. (*C* ∨ (~*A* ∧ ~*B*)) ≡ ((*A* → *C*) ∧ (*B* → *C*))

a.

(*A* ∧ *B*) → *C* ≡ (*A* → *C*) ∨ (*B* → *C*) (Correct)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| A | B | *C* | *A* ∧ *B* | (*A* ∧ *B*) → *C* |
| T | T | T | T | T |
| T | T | F | T | F |
| T | F | T | F | T |
| T | F | F | F | T |
| F | T | T | F | T |
| F | T | F | F | T |
| F | F | T | F | T |
| F | F | F | F | T |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| A | B | C | (*A* → *C*) | (*B* → *C*) | (*A* → *C*) ∨ (*B* → *C*) |
| T | T | T | T | T | T |
| T | T | F | F | F | F |
| T | F | T | T | T | T |
| T | F | F | F | T | T |
| F | T | T | T | T | T |
| F | T | F | T | F | T |
| F | F | T | T | T | T |
| F | F | F | T | T | T |

b.

(*C* ∨ (~*A* ∧ ~*B*)) ≡ ((*A* → *C*) ∧ (*B* → *C*)) (Correct)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| A | B | C | ~A | ~B | ~*A* ∧ ~*B* | (*C* ∨ (~*A* ∧ ~*B*)) |
| T | T | T | F | F | F | T |
| T | T | F | F | F | F | F |
| T | F | T | F | T | F | T |
| T | F | F | F | T | F | F |
| F | T | T | T | F | F | T |
| F | T | F | T | F | F | F |
| F | F | T | T | T | T | T |
| F | F | F | T | T | T | T |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| A | B | C | *A* → *C* | *B* → *C* | ((*A* → *C*) ∧ (*B* → *C*)) |
| T | T | T | T | T | T |
| T | T | F | F | F | F |
| T | F | T | T | T | T |
| T | F | F | F | F | F |
| F | T | T | T | T | T |
| F | T | F | T | F | F |
| F | F | T | T | T | T |
| F | F | F | T | T | T |

1. (2 marks) Simplify the followings as much as possible.
   1. ~(~*A* ∧ *B*) ∧ (*A* ∨ *B*)
   2. ~((~*A* ∧ *B*) ∨ (~*A* ∧ ~*B*))

t: tautology c:contradiction

c.

~(~*A* ∧ *B*) ∧ (*A* ∨ *B*) = ( A ∨ ~B ) ∧ (A ∨ B ) = A ∨ ( ~B ∧ B) = A ∨ c = A

d.

~((~*A* ∧ *B*) ∨ (~*A* ∧ ~*B*)) = ~( ~A ∧ ( B ∨ ~B )) = ~ ( ~A ∧t ) = A ∨ c = A