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| COMP 2121 **DISCRETE MATHEMATICS** | LAB 3 |

1. Let 𝑎 → (𝑏 ∧ 𝑐) be false. What is the truth value of the following statements:

*i)* 𝑎 ∧ 𝑏 ∧ 𝑐 *ii)* ¬𝑎 ∨ (𝑏 ∧ 𝑐)

*iii)* (𝑏 ∧ 𝑐) → 𝑎 *iv)* ¬(𝑏 ∧ 𝑐) → ¬𝑎

*v)* (𝑏 ∧ 𝑡) → (𝑎 ∨ 𝑟) *vi)* (𝑎 ∨ 𝑟) → (𝑏 ∧ 𝑡)

1. Construct a truth table for the statement ¬(𝑎 ∨ ¬𝑏) → ¬𝑎.
2. Negate the statement (𝑎𝑎 ∨ ¬𝑏𝑏) → ¬𝑐𝑐 and simplify the result.
3. Negate the sentence: If 𝑎𝑎 = 𝑏𝑏 and 𝑐𝑐 + 𝑑𝑑 > 50 then this graph is bipartite.
4. Consider the following argument and provide reason for each step

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| ¬𝑏𝑏 |  | | |
| (¬𝑎𝑎 ∨ 𝑐𝑐) → 𝑡𝑡 | STEPS |  | REASON |
| ¬𝑎𝑎 ∨ 𝑛𝑛  ¬𝑏𝑏 → ¬𝑡𝑡 | 1) | ¬𝑏𝑏 |  |
| ∴ 𝑛𝑛 ∨ 𝑘𝑘 | 2) | ¬𝑏𝑏 → ¬𝑡𝑡 |  |
|  | 3) | ¬𝑡𝑡 |  |
|  | 4) | (¬𝑎𝑎 ∨ 𝑐𝑐) → 𝑡𝑡 |  |
|  | 5) | ¬(¬𝑎𝑎 ∨ 𝑐𝑐) |  |
|  | 6) | 𝑎𝑎 ∧ ¬𝑐𝑐 |  |
|  | 7) | 𝑎𝑎 |  |
|  | 8) | ¬𝑎𝑎 ∨ 𝑛𝑛 |  |
|  | 9) | 𝑛𝑛 |  |
|  | 10) | ∴ 𝑛𝑛 ∨ 𝑘𝑘 |  |

1. Use the rules of inference to show that the following arguments are valid. Provide the rule for each step.

# STEPS REASON

a) ¬𝑡𝑡

¬𝑠𝑠

𝑎𝑎 → 𝑡𝑡

∴ ¬(𝑎𝑎 ∨ 𝑠𝑠)

# STEPS REASON

b) 𝑥𝑥 → (𝑦𝑦 → 𝑧𝑧)

𝑥𝑥

¬𝑦𝑦 → ¬𝑥𝑥

∴ 𝑧𝑧

# STEPS REASON

c) ¬𝑠𝑠

𝑝𝑝 → (𝑞𝑞 → 𝑟𝑟)

𝑡𝑡 → 𝑞𝑞

𝑝𝑝 ∨ 𝑠𝑠

∴ ¬𝑟𝑟 → ¬𝑡𝑡

# STEPS REASON

d) 𝑎𝑎 ∧ 𝑏𝑏

¬𝑥𝑥

𝑎𝑎 → (𝑟𝑟 ∧ 𝑏𝑏)

(𝑟𝑟 ∨ 𝑛𝑛) → (𝑥𝑥 ∨ 𝑝𝑝)

∴ 𝑝𝑝

1. Use contradiction to prove the following argument:

# STEPS REASON

𝑝𝑝 → 𝑞𝑞

(𝑞𝑞 ∧ 𝑟𝑟) → 𝑠𝑠

𝑟𝑟

∴ 𝑝𝑝 → 𝑠𝑠

If all of the problems can’t be done in the lab period, students can work on them on their own.

**No Name identity:** *p*  *q*  *p*  *q*

**Contrapositive:** *p*  *q*  *q*  *p*

