**Penugasan Logika Informatika**

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Dosen Pengampu: Ikhwan Baidlowi Sumafta, S.Kom., M.Kom.

Nama : Mohamad Malik Fajar Baihaqi

NIM/Prodi/Kelas : 254311011 / TRPL / 1A

# Ekuivalensi Logis

1. **Tugas**

Buktikan bahwa ekspresi-ekspresi logika berikut ini ekuivalen dengan menggunakan tabel kebenaran:

1. **¬A ↔ B ≡ (¬A ∨ B) ∧ (¬B ∨ A)**

|  |  |  |  |
| --- | --- | --- | --- |
| A | B | ¬A | ¬A **↔** B |
| T | T | F | F |
| T | F | F | T |
| F | T | T | T |
| F | F | T | F |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| A | B | ¬A | ¬B | ¬A ∨ B | ¬B ∨ A | (¬A ∨ B) ∧ (¬B ∨ A) |
| T | T | F | F | T | T | T |
| T | F | F | T | F | T | F |
| F | T | T | F | T | F | F |
| F | F | T | T | T | T | T |

**¬A ↔ B ≠ (¬A ∨ B) ∧ (¬B ∨ A)** : Tidak Ekuivalen secara logis

1. **A → (¬A → B) ≡ 1**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| A | B | ¬A | ¬A →B | A → (¬A →B) |
| T | T | F | T | T |
| T | F | F | T | T |
| F | T | T | T | T |
| F | F | T | F | T |

**A → (¬A → B) ≡ 1 :** Ekuivalen (Tautologi)

1. **(A ∨ ¬B) → C ≡ (¬A ∧ B) ∨ C**

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

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| A | B | C | ¬A | ¬A ∧ B | (¬A ∧ B) ∨ C |
| T | T | T | F | F | T |
| T | T | F | F | F | F |
| T | F | T | F | F | T |
| T | F | F | F | F | F |
| F | T | T | T | T | T |
| F | T | F | T | T | T |
| F | F | T | T | F | T |
| F | F | F | T | F | F |

**(A ∨ ¬B) → C ≡ (¬A ∧ B) ∨ C :** Ekuivalen secara logis

1. **A → (B → C) ≡ (A → B) → C**

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

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| 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 | T | T |
| F | T | F | T | F |
| F | F | T | T | T |
| F | F | F | T | F |

**A → (B → C) ≠ (A → B) → C :** Tidak Ekuivalen secara logis

1. **A → B ≡ ¬(A ∧ ¬B)**

|  |  |  |
| --- | --- | --- |
| A | B | A → B |
| T | T | T |
| T | F | F |
| F | T | T |
| F | F | T |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| A | B | ¬B | A ∧ ¬B | ¬(A ∧ ¬B) |
| T | T | F | F | T |
| T | F | T | T | F |
| F | T | F | F | T |
| F | F | T | F | T |

**A → B ≡ ¬(A ∧ ¬B) :** Ekuivalen secara logis

1. **¬( ¬(A ∧ B) ∨ B ≡ 0**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| A | B | A ∧ B | ¬(A ∧ B) | ¬( ¬(A ∧ B) | ¬( ¬(A ∧ B) ∨ B |
| T | T | T | F | T | T |
| T | F | F | T | F | F |
| F | T | F | T | F | T |
| F | F | F | T | F | F |

**¬( ¬(A ∧ B) ∨ B ≡ 0 :** Tidak Ekuivalen (Bukan Kontradiksi)

1. **((A ∧ (B → C)) ∧ (A → (B → ¬C))) → A ≡ 1**

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

**((A ∧ (B → C)) ∧ (A → (B → ¬C))) → A ≡ 1 :** Ekuivalen (Tautologi)

1. **Contoh/Latihan Soal (Di dalam Materi)**
2. **Contoh 1**
3. Dewi sangat Cantik dan Peramah
4. Dewi Peramah dan sangat Cantik

A=Dewi sangat Cantik

B=Dewi Peramah

1. A ∧ B
2. B ∧ A

|  |  |  |  |
| --- | --- | --- | --- |
| A | B | A ∧ B | B ∧ A |
| T | T | T | T |
| T | F | F | F |
| F | T | F | F |
| F | F | F | F |

**A ∧ B ≡ B ∧ A :** Ekuivalen secara Logis (Contingent)

Karena urutan nilai kebenarannya sama yaitu T,F,F,F.

serta berlaku hukum/sifat **Komutatif**.

1. **Contoh 2**
2. Badru tidak Pandai, atau dia tidak Jujur
3. Adalah tidak benar jika Badru pandai dan jujur

A=Badru Pandai

B=Badru Jujur

1. ¬A ∨ ¬B
2. ¬(A ∧ B)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| A | B | ¬A | ¬B | A ∧ B | ¬A ∨ ¬B | ¬(A ∧ B) |
| T | T | F | F | T | F | F |
| T | F | F | T | F | T | T |
| F | T | T | F | F | T | T |
| F | F | T | T | F | T | T |

**¬A ∨ ¬B ≡ ¬(A ∧ B) :** Ekuivalen secara Logis (Contingent)

Karena urutan nilai kebenarannya sama yaitu F,T,T,T.

serta berlaku hukum/sifat **De Morgan**.

1. **Contoh 3**
2. ((A ∧ B) ∨ C)
3. (A ∧ (B ∨ C))

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

**(A ∧ B) ∨ C) ≠ A ∧ (B ∨ C) :** Tidak Ekuivalen secara Logis

Karena kedua ekspresi tersebut merupakan **Contingent,** Namun urutan

Tidak sama.

serta tidak berlaku hukum/sifat **Asosiatif** karena didalam masing-masing

ekspresi terdapat 2 perangkai logika yang berbeda.

1. **Contoh 4**
2. Jika Badru tidak Sekolah, maka Badru tidak akan pandai
3. Jika Badru pandai, maka Badru pasti Sekolah

A=Badru Sekolah

B=Badru Pandai

1. ¬A **→** ¬B
2. B **→**  A

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| A | B | ¬A | ¬B | ¬A → ¬B | B → A |
| T | T | F | F | T | T |
| T | F | F | T | T | T |
| F | T | T | F | F | F |
| F | F | T | T | T | T |

**¬A → ¬B ≡ B → A :** Ekuivalen secara Logis (Contingent)

Karena urutan nilai kebenarannya sama yaitu T,T,F,T.

1. **Contoh 5**
2. A ↔ B
3. (A → B) ∧ (B → A)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| A | B | A → B | B → A | A ↔ B | (A → B) ∧ (B → A) |
| T | T | T | T | T | T |
| T | F | F | T | F | F |
| F | T | T | F | F | F |
| F | F | T | T | T | T |

**A ↔ B ≡ (A → B) ∧ (B → A)** **:** Ekuivalen secara Logis (Contingent)

Karena urutan nilai kebenarannya sama yaitu T,F,F,T.