Øving 2, Introduksjon til Kunstig Intelligens

# Models and Entailment in Propositional Logic

2. ¬A ∧ ¬B ⊨ ¬B

|  |  |  |
| --- | --- | --- |
|  | **¬A ∧ ¬B** | **¬B** |
| A=B=1 | False | False |
| A=1, B=0 | False | True |
| A=0, B=1 | False | False |
| A=B=0 | True | True |

**Uttrykket er sant**

1. ¬A ∨ ¬B ⊨ ¬B

|  |  |  |
| --- | --- | --- |
|  | **¬A ∨ ¬B** | **¬B** |
| A=B=1 | False | False |
| A=1, B=0 | True | True |
| A=0, B=1 | True | False |
| A=B=0 | True | True |

**Uttrykket er usant**

1. ¬A ∧ B ⊨ A ∨ B

|  |  |  |
| --- | --- | --- |
|  | **¬A ∧ B** | **A ∨ B** |
| A=B=1 | False | True |
| A=1, B=0 | False | True |
| A=0, B=1 | True | True |
| A=B=0 | False | False |

**Uttrykket er sant**

1. A ⇒ B ⊨ A ⇔ B

|  |  |  |
| --- | --- | --- |
|  | **A ⇒ B** | **A ⇔ B** |
| A=B=1 | True | True |
| A=1, B=0 | False | False |
| A=0, B=1 | True | False |
| A=B=0 | True | True |

**Uttrykket er usant**

1. (A ⇒ B) ⇔ C ⊨ A ∨ ¬B ∨ C

|  |  |  |
| --- | --- | --- |
|  | **(A ⇒ B) ⇔ C** | **A ∨ ¬B ∨ C** |
| A=B=1, C=0 | False | True |
| A=1, B=0, C=0 | True | True |
| A=0, B=1, C=0 | False | False |
| A=B=C=0 | False | True |
| A=B=1, C=1 | True | True |
| A=1, B=0, C=1 | False | True |
| A=0, B=1, C=1 | True | True |
| A=B=C=1 | True | True |

**Uttrykket er sant**

1. (¬A ⇒ ¬B) ∧ (A ∧ ¬B) is satisfiable?

|  |  |
| --- | --- |
|  | **(¬A ⇒ ¬B) ∧ (A ∧ ¬B)** |
| A=B=1 | False |
| A=1, B=0 | True |
| A=0, B=1 | False |
| A=B=0 | False |

**Uttrykket er *satisfiable!***

1. (¬A ⇔ ¬B) ∧ (A ∧ ¬B) is satisfiable?

|  |  |
| --- | --- |
|  | **(¬A ⇔ ¬B) ∧ (A ∧ ¬B)** |
| A=B=1 | False |
| A=1, B=0 | False |
| A=0, B=1 | False |
| A=B=0 | False |

**Uttrykket er ikke *satisfiable!***

2. ¬A38 ∧ ¬A49:  **modeller**
3. A27 ∧ ¬A46 ∧ A57:  **modeller**
4. A27 ∧ (A46 ∨ ¬A57):  **modeller**
5. ¬A85 ⇒ ¬A91: **modeller**
6. ¬A14 ⇔ ¬A19) ∧ (A21 ⇒ A22):  **modeller**
7. A41 ∧ ¬A59 ∧ A64 ∧ ¬A85 ∧ A87 ∧ ¬A90:  **modeller**

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| P(3,1) | P(3,2) | P(3,3) | P(4,4) | B(4,1) | B(4,2) | B(4,3) | KB | α(1) | α(2) | α(3) | α(4) |
| True | True | True | True | True | True | True | False |  |  |  |  |
| True | True | True | False | True | True | True | False |  |  |  |  |
| True | True | False | True | True | True | True | False |  |  |  |  |
| True | True | False | False | True | True | False | False |  |  |  |  |
| True | False | True | True | True | False | True | True |  |  |  |  |
| True | False | True | False | True | False | True | True |  |  |  |  |
| True | False | False | True | True | False | True | True |  |  |  |  |
| True | False | False | False | True | False | False | False |  |  |  |  |
| False | True | True | True | False | True | True | False |  |  |  |  |
| False | True | True | False | False | True | True | False |  |  |  |  |
| False | True | False | True | False | True | True | False |  |  |  |  |
| False | True | False | False | False | True | False | False |  |  |  |  |
| False | False | True | True | False | False | True | False |  |  |  |  |
| False | False | True | False | False | False | True | False |  |  |  |  |
| False | False | False | True | False | False | True | False |  |  |  |  |
| False | False | False | False | False | False | False | False |  |  |  |  |

|  |
| --- |
|  |
|  |

”Knowledge base is true”

”α(#) is true”

Ut fra dette kan vi konkludere med at **KB |= α(1) og KB |= α(4) er sanne**, fordi der hvor KB er True er også α(1) og α(4) True

# Resolution in Propositional Logic

2. A ∨ (B ∧ C ∧ ¬D)   
   ≡ **(A ∨ B) ∧ (A ∨ C) ∧ (A ∨ ¬D)**
3. ¬(A ⇒ ¬B) ∧ ¬(C ⇒ ¬D)   
   ≡ ¬(¬A ∨ ¬B) ∧ ¬(¬C ∨ ¬D)   
   ≡ ¬¬(A ∧ B) ∧ ¬¬(C ∧ D)  
   ≡ **A ∧ B ∧ C ∧ D**
4. ¬((A ⇒ B) ∧ (C ⇒ D))  
   ≡ ¬((¬A ∨ B) ∧ (¬C ∨ D))  
   ≡ ¬((¬A ∧ ¬C) ∨ (¬A ∧ D) ∨ (B ∧ ¬C) ∨ (B ∧D))  
   ≡ **(A ∨ C) ∧ (A ∨ ¬D) ∧ (¬B ∨ C) ∧ (¬B ∨ ¬D)**
5. (A ∧ B) ∨ (C ⇒ D)  
   ≡ (A ∧ B) ∨ ¬C ∨ D

≡ (A ∨ ¬C) ∧ (A ∨ D) ∧ (B ∨ ¬C) ∧ (B ∨ D)

≡ **(A ∨ ¬C ∨ D) ∧ (B ∨ ¬C ∧ D)**

1. A ⇔ (B ⇒ ¬C) ≡ A ⇔ (¬B ∨ ¬C)

≡ (A ⇒ (¬B ∨ ¬C)) ∧ ((¬B∨ ¬C) ⇒ A)

≡ (¬A ∨ ¬B ∨ ¬C) ∧ (¬¬(B ∧ C) ∨ A)

≡ (¬A ∨ ¬B ∨ ¬C) ∧ (A ∨ B) ∧ (A ∨ C)