Lecture two:

Propositional logic

The Propositional calculus

• **Truth symbols**: true, false
• **Propositional symbols**: P, Q, S, ... (**Atomic sentences**)
• **Wrapping parentheses**: (…)
• **Sentences are combined by connectives**:
∧ ...and [conjunction]
∨ ...or [disjunction]
⇒ ...implies [implication / conditional]
⇔. .is equivalent [biconditional]

¬ ...not [negation]

Examples:

Ali is a brave man

This car has 4 wheels

If weather is cold then it is winter

P Q

P →Q

Condition evident or conclusion

Laws:

~(~P) ≡ P

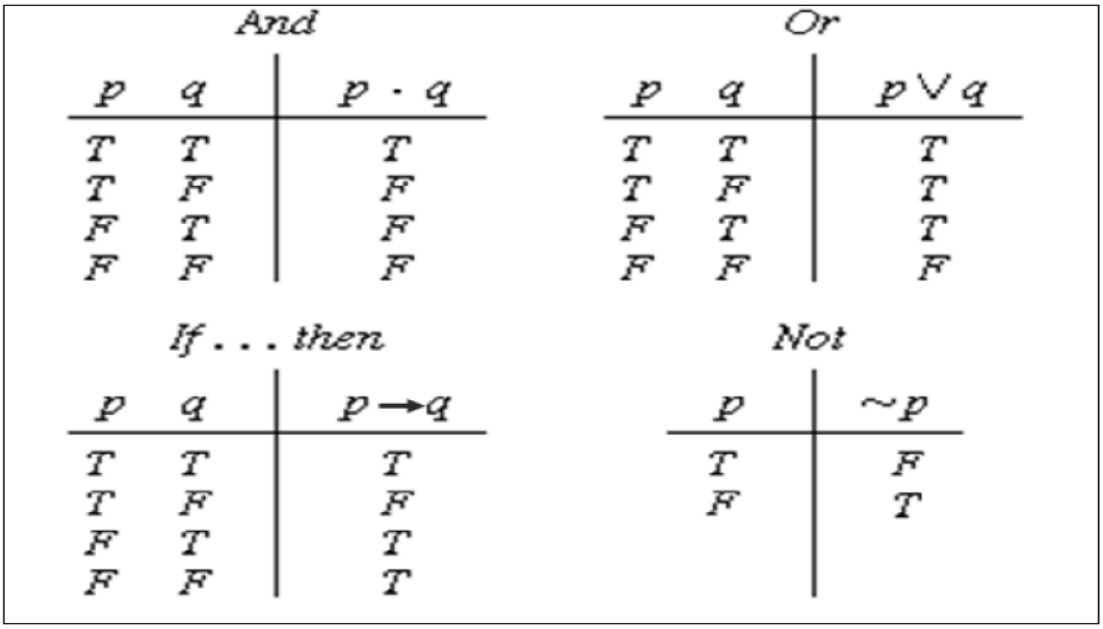
P →Q ≡ ~PVQ

PVQ ≡QV P

P^ Q ≡ Q^P

~ (PV Q) ≡ ~P^ ~Q

~ (P^ Q) ≡ ~P V~Q



Examples

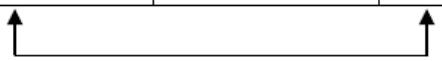
(P ∧ Q) ∨(¬ Q ∨ P)

P	Q	P∧Q	¬Q	¬Q∨P	(P∧Q)∨(¬Q∨P)
T	T	T	F	T	T
T	F	F	T	T	T
F	T	F	F	F	F
F	F	F	T	T	T

A→B ≡ ¬A∨B

A	B	A→B	¬A	¬A∨B
T	T	T	F	T

T	F	F	F	F
F	T	T	T	T
F	F	T	T	T



Homework:

1. $a \wedge (b \vee c) \equiv (a \wedge b) \vee (a \wedge c)$
2. $a \vee (b \wedge c) \equiv (a \vee b) \wedge (a \vee c)$

Predicate Logic:

To solve the limitations in the prepositional calculus, you need to analyze propositions into predicates and arguments, and deal explicitly with quantification. *Predicate Logic* provides formalism for performing this analysis of prepositions and additional methods for reasoning with quantified expressions.

Ali is a man

Man(ali)

is(ali,man)

object(obj1,obj2,…..).

1-Facts

Maha is a girl

Girl(maha)

Is(maha,girl).

I have a book

Have (I) book

Ali is a brave man

Is (ali , man, brave)

Man (ali,brave)

Brave (ali,man).

Man(ali) ^ brave (ali)

Ali have red car

Have (ali, car,red)

Have (ali,car) ^ colour(car,red)

This is sunny day

Is(day,sunny)

Sunny(day).

Maha has 4 books

Have(maha,4,book)

Have (maha,book) ^number (book,4)

Ali going to school now

go(ali,school) ^time(now)

I have one or two books

Have (I,books) ^ (number(books,1) V number(books,two))

2- rules

If its winter then it is cold

Is(weather,winter) →is (weather,cold)

Weather (winter) → weather (cold)

When I'm sick , I will go to the doctor

Sick(I) → go (I,doctor)

I f student will read good he will pass

Read(X,good) → pass(X).

Ahmed got to the school when he is 6 years old

Age (ahmed,6)→ go(ahmed,school).

Example:

Write predicate for book in library

Book(“artificial intelligence”,’gorge lugur”,2009,10)

Book(“c++”,”xt”,2009,9).

Example: write predicate for cars

Car(“BMW”,”black”,”1990”,”full automatic”, “special”).

Car(“Mazda”,”white”,”1995”,”ordinarily”, “special”).

Car(“chery”,”yello”,”2009”,”full automatic”, “Taxi”).

Calling types:-

Book(“prolog”,”A.I”,”Gourge”,10,2000).

Book(“c++”,”programming”,”Rintice Hill”,5,2001).

Book(“Expert system”,”A.I”,”Daniel”,5,1994).

Goal: book(X,Y,A,b,C).

false عدم المطابقة بسبب اختلاف اسمpredicate

No

Goal: book(A,B,C,D)

No عدم مطابقة بسبب اختلاف عدد arguments

Goal:book(A,B,C,D,E)

A=Prolod, B=A.I , C=George , D=10, E=2000

A=c++, B=programming, C=printce hill, D= 5, E=2001

A=expert system , B=A.I, C= Daniel, D=5, E=1994.

3/ solution

Yes

Goal: book(A,"A.I"),C,D,X).

A=prolog, C=George ,D=10,X=2000

A=expert, C=Daniel , D=5,X=2000.

2/SOLUTIONS

Goal: book(X,Y,Z,10,W).

X=Expert, Y=A.I , Z=George, W=2000

1/ SOLUTION

Goal: book("prolog",A,C,N,2000)

A=A.I , C=George, N=10

1/ solution

Goal: book(A,"A.I",X,Y,2004).

No Solution

Goal: book(c++,A,B,20,X).

No Solution

ملاحظة مهمة جدا: المتغيرات Variables بلغة برولوك يكتب ب Capital letter.

Goal: Book("c++","programming","Rintice Hill",5,2001).

Yes

Book(“C++”,”A.I”,”Gourge”,10,2000).

NO

ملاحظة مهمة جدا : اذا اخذ ثابت قيمة معينة لايجوز تغييرها في نفس ال Predicate.

H.W

Goal: BOOK(A,”A.I”,N,P,2000).

Goal: book(A,”A.I”,X,5,1993).

Family Relations

Son(ali,ahmed).

Son(ahmed,majed).

Son(mohammed,taha).

Son(Hamza,ahmed).

Son(hussain,majed).

Son (Hassan ,hussain).

Father (X,Y):-son(X,Y).

Brother(X,Y):-father(Z,X),dather(Z,Y).

Grandfather(X,Y):-father(X,Z),father(Z,Y).

Cousin(X,Y):-father(Z,X),father(W,Y),brother(Z,W).

Goal

Father(,ali,B).

B=ahmed. Yes

Goal

Brother(hamza,C)

↧⇸ Father(Z,hamza) , father(Z,C)