

Discrete Structures 1/22

Why are we here?

- The class is purely mathematical
- Lot of binary numbers
- Learn how to proof write
- We are gonna talk about set operations

Section 1.1:

Propositional logic

Definition: A proposition is a declarative sentence that is either true or false

Example:

Today is Tuesday. Proposition value: False

Des Moines is a capital of Iowa. Proposition value: True

$4+2 = 6$ proposition value: True

$X + 1 = 3$ Not proposition: depending on value of x. Can be T or F

What is your major? Not proposition:

Follow my steps. Not a proposition

Computer science is the study of computation, information, and automation. Proposition

We use letters for propositional variables: p,q,r,s,t

T - true, F - false

P: Today is Wednesday value of p is T.

Atomic proposition:

Definition: Is a proposition that cannot be expressed in terms of another proposition.

Examples:

Today is a sunny day.

Not atomic:

Today is Tuesday and it is sunny

Not

Definition: Let p be a proposition, the negative of p, decided by $\neg p$ and is a statement. "It is not the case that p"

Ex:

P: today is wednesday

$\neg p$: It is not the case that today is wednesday.

Today is not wednesday.

P not p

T F

F T

Conjunction:

Def: let p and q be propositions. The conjunction of p and q denoted by $p \wedge q$ is a proposition "p and q". It is only true if both p and q are true.

P Q $p \wedge q$ (combinations)

T T T

T F F

F T F

F F F

Ex: p: Today is wednesday. q: Today is sunny.

$p \wedge q$: today is wednesday and it is sunny

False: part of it is false

Or

Def: let p and q be propositions. The disjunction of p or q, denoted by $p \vee q$ is a proposition "p or q" only false if both are false.

P Q $p \vee q$ (combinations)

T T T

T F T

F T T

F F F

Ex: p: Today is wednesday. q: Today is sunny.

$p \vee q$: today is wednesday or it is sunny

True: part of it is true

Exclusive Or

Def: denoted by $p \oplus q$. Is a proposition "p xor q", true if only one of p or q is true

P Q $p \oplus q$ (combinations)

T T F

T F T

F T T

F F F

Conditional statements:

Def: let p and q be propositions. The conditional statement p implies q, denoted by $P \rightarrow Q$, is statement "if p then q"

Ex:

P Q $P \rightarrow Q$ (combinations)

T T T

T F F

F T T (struggle)

F F T

P	Q	$p \wedge q$	$p \vee q$	$p \oplus q$	$P \rightarrow Q$
T	T	T	T	F	T
T	F	F	T	T	F
F	T	F	T	T	T
F	F	F	F	F	T