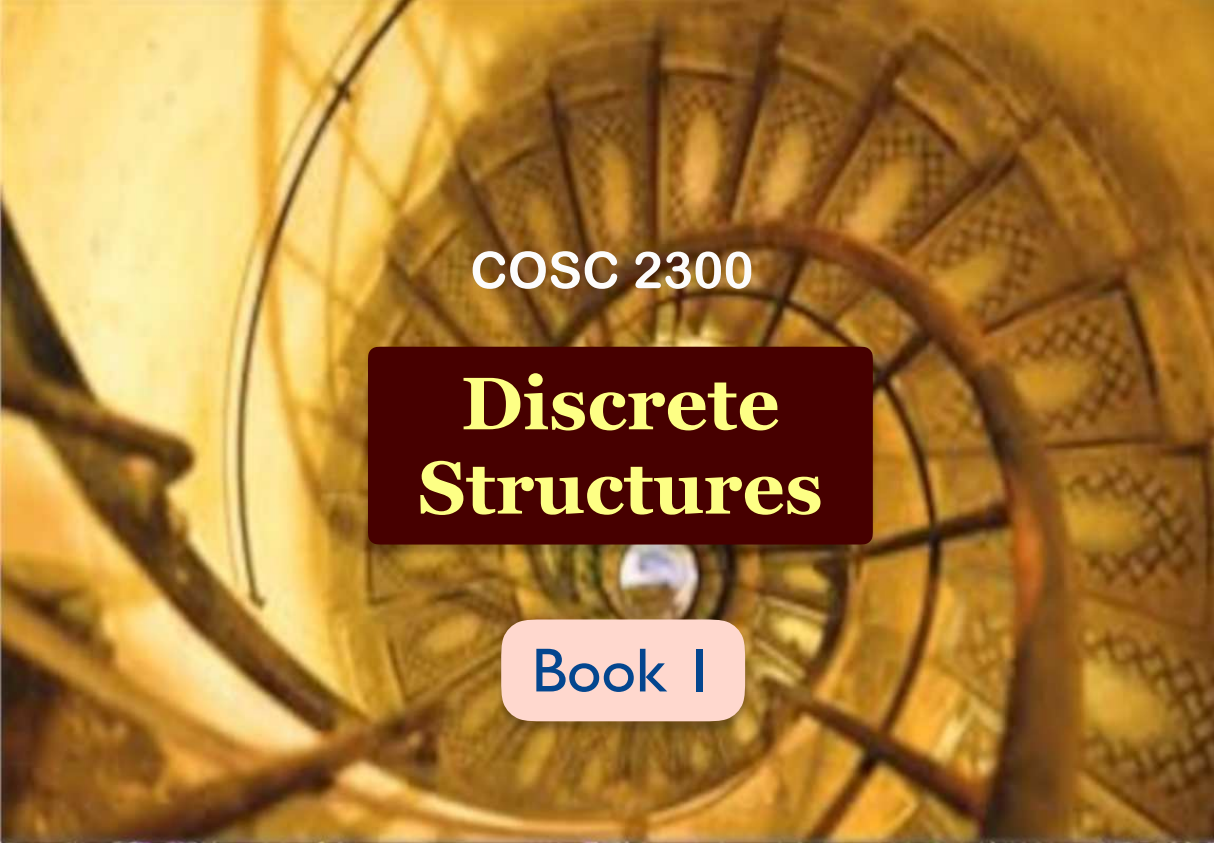
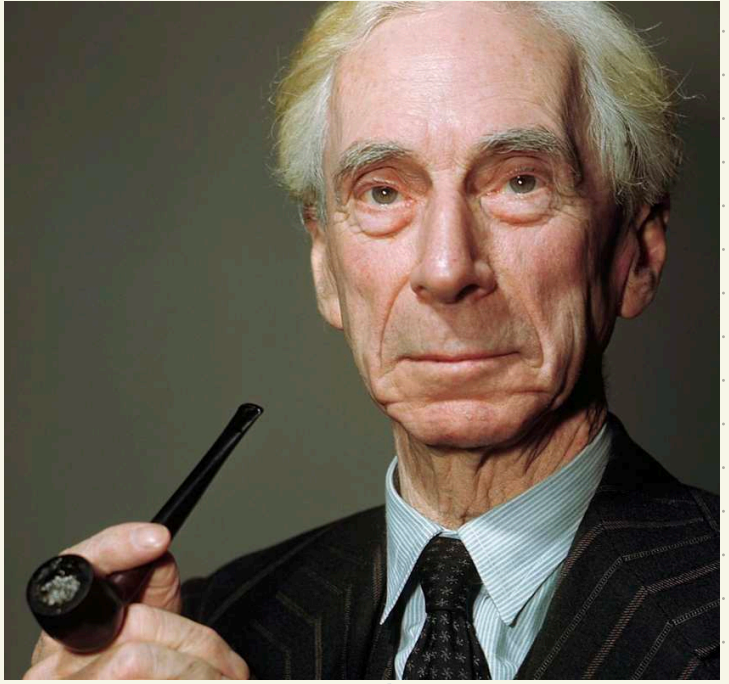

COSC 2300
Discrete Structures
Book I



Bertrand Russell (1872-1970)

In a particular village there is a gentleman barber who shaves every gentleman who does not shave himself.

Does the barber shave himself?

No true/false answer can be given that is consistent.

This is an example of Russell's Paradox.

Other forms:

P: The statement P (ie. this statement) is false.

Avoiding self-referential statements:

A: The statement B is true.

B: The statement A is false.

Propositional Logic (Propositional Calculus)

R: Bertrand Russell was born in 1872. (True)

M: Mars is the second planet from the sun. (False)

J: January is the first month of the calendar year. (True)

T: A triangle has four sides. (False)

Syntactic vs. semantic features language

syntax (symbolic) — meaning (semantics) true/false

R: Bertrand Russell was born in 1872. (True)
M: Mars is the second planet from the sun. (False)
J: January is the first month of the calendar year. (True)
T: A triangle has four sides. (False)

"Exclusive or" of T and T is F. Avoid!

$R \vee M$ is True
- "or"
- "join"
- "disjunction"

$R \wedge M$ is False
- "and"
- "meet"
- "conjunction"

"inclusive" or

Truth Table: for two statements P, Q (atomic propositions)

P	¬P
T	F
F	T

P	Q	P∨Q	P∧Q
T	T	T	T
T	F	T	F
F	T	T	F
F	F	F	F

Conditional Statements $P \to Q$ ("P implies Q") ("If P then Q")
(implication)

P	Q	P→Q
T	T	T
T	F	F
F	T	T
F	F	T

$R \to M$ is false
$J \to R$ is true.
$T \to M$ is true.

$(P \wedge Q) \wedge R \equiv P \wedge (Q \wedge R)$
↑ equivalence of propositions

$P \wedge Q \equiv Q \wedge P$

$P \to Q \equiv (\neg P) \vee Q$

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

$(P \vee Q) \vee R \equiv P \vee (Q \vee R)$

$P \vee (Q \wedge R) \equiv (P \vee Q) \wedge (P \vee R)$

$P \wedge (Q \vee R) \equiv (P \wedge Q) \vee (P \wedge R)$

$a(b+c) = ab + ac$

$a + bc \neq (a+b)(a+c)$