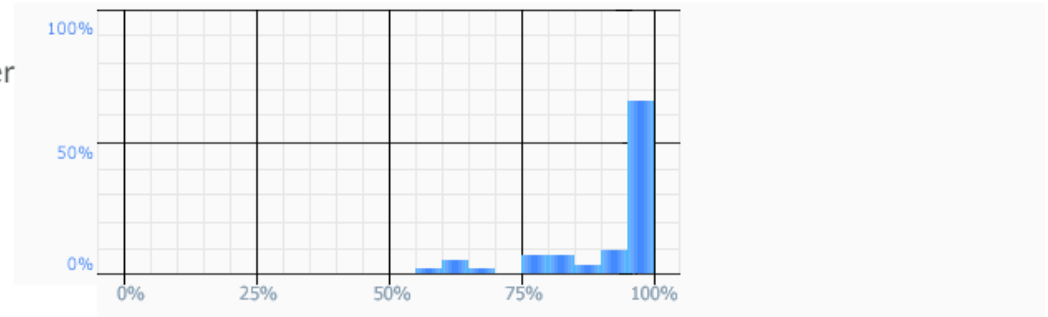
View By: Groups Groups: 1219-MATH.135.019.1.LEC Apply

MQ3 (Fri Sep 17) Class Statistics

Number of submitted grades: 58 / 60

Minimum:	57.5 %
Maximum:	100 %
Average:	91.94 %
Mode:	100 %
Median:	100 %
Standard Deviation:	12 %

Grade Distribution



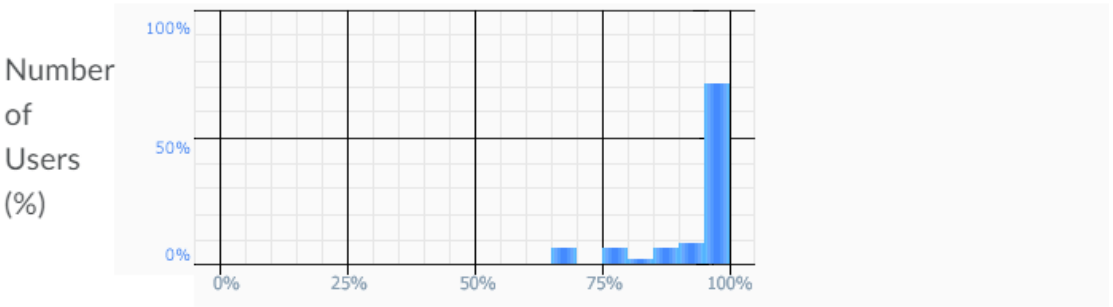
View By: Groups Groups: 1219-MATH.135.016.1.LEC Apply

MQ3 (Fri Sep 17) Class Statistics

Number of submitted grades: 49 / 52

Minimum:	67.5 %
Maximum:	100 %
Average:	94.54 %
Mode:	100 %
Median:	100 %
Standard Deviation:	9.74 %

Grade Distribution



- Monday 20 September:
  - Mobius Quiz 4
- Tuesday 21 September:
  - Complete reading up to Chapter 3.6 of the course notes. **Pages 35-57.**
- **Wednesday 22 September:**
  - **Complete Written Assignment 2: WA2**
- Wednesday 22 September:
  - Mobius Quiz 5
- Thursday 23 September:
  - WA02 solutions will be posted, hopefully before 12pm: Check the solutions in detail!
- Friday 24 September before class:
  - Mobius Quiz 6
- Sunday 26 September:
  - Complete reading up to the end of Section 0.3 (Polynomials)

View By: Groups Groups: 1219-MATH.135.019.1.LEC Apply

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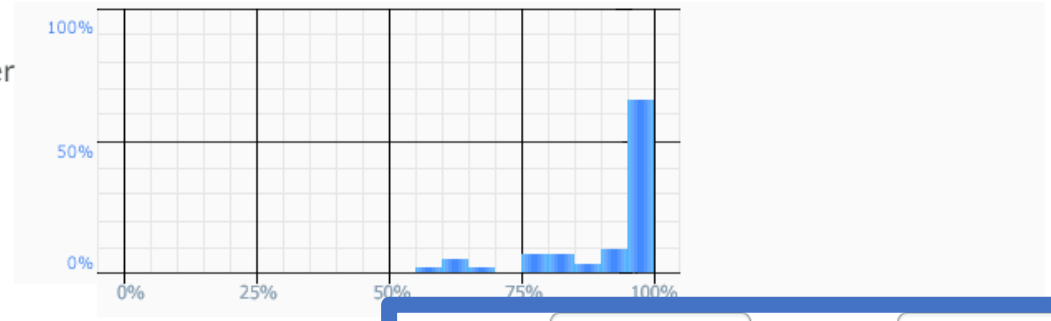

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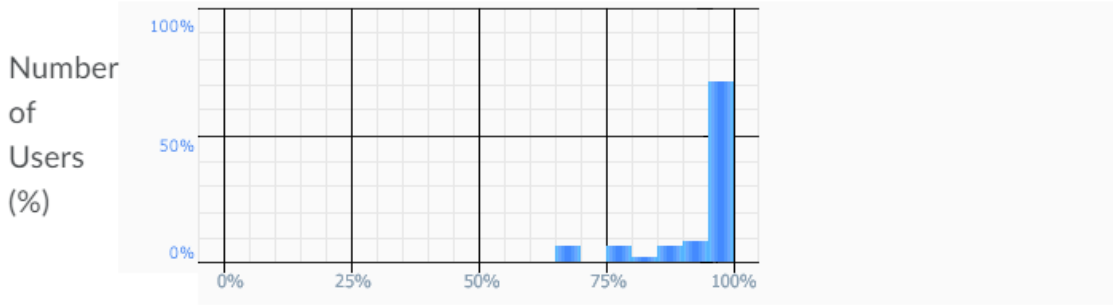


View By: Groups Groups: MATH135_1219_LEC Apply

MQ3 (Fri Sep 17) Class Statistics

Number of submitted grades: 1,196 / 1,276

Minimum:	0 %
Maximum:	100 %
Average:	92.09 %

Office hours: Mondays and Wednesdsays 5-6pm.

MC 4059

Also: online tutorial center

MATH 135: Lecture 6

Dr. Nike Dattani

20 September 2021

How many of you find if and only if statements confusing?

Today I am going to confuse you.

Who is ready to be confused?

"I come to campus ***only if*** I have to teach MATH 135"

Do I come to campus if there's no MATH 135?

If there's MATH 135 then do I come to campus?

If I have to teach MATH 135 ***then*** I come to campus: A => B

I come to campus ***only if*** I have to teach MATH 135: B => A

I come to campus ***iff*** I have to teach MATH 135: B => A (***if*** is from ***only if***)

B <= A (only ***if*** is from ***if/then***)

I have to teach MATH 135 ***iff*** I come to campus: A <= B (***if*** is from ***only if***)

A => B (only ***if*** is from ***if/then***)

"The ***only*** positive integers ***are*** those in ℚ."

- Is this ***iff*** ?

- Positive integer => ℚ (it's the ***only*** way something can be a positive integer)
- ℚ => Positive integer? (some ℚ ***are*** positive integers, **but** some ℚ might **not** be)

- Q2c on WA02 had a typo.
  - It was written as only A => B, but should be A <=> B.

"The integers are positive ***exactly*** when they are in ℚ."

- Is this ***iff*** ?
- Integer is positive => ℚ (they're positive when in ℚ, and ***never otherwise***)
- ℚ => Positive integer? (Some ℚ are not integers, ***it says nothing about ℚ?***)

Nike goes to class exactly when Charlie goes to class.

Nike goes at 2pm and 3pm
Charlie goes when?

Charlie goes to class at 2pm, 3pm, and 4pm
Nike only goes when Charlie goes (e.g. 2pm and 3pm) but does he have to got at 4pm?

Nike goes when Charlie goes, but is it only when Charlie goes?

A exactly when B

- B => A

But previously we agreed:

"The integers are positive ***exactly*** when they are in B."

- Positive integer => B (they're positive when in B, and ***never otherwise***)
- B => Positive integer? (Some B are not integers, ***it says nothing about B?***)

Now it seems to say B => positive integer, and ***nothing about A's impact on B***

If and only if

From Wikipedia, the free encyclopedia

"Iff" redirects here. For other uses, see IFF (disambiguation).
"↔" redirects here. It is not to be confused with Bidirectional traffic.
"⟺" redirects here. For other uses, see Arrow (symbol).

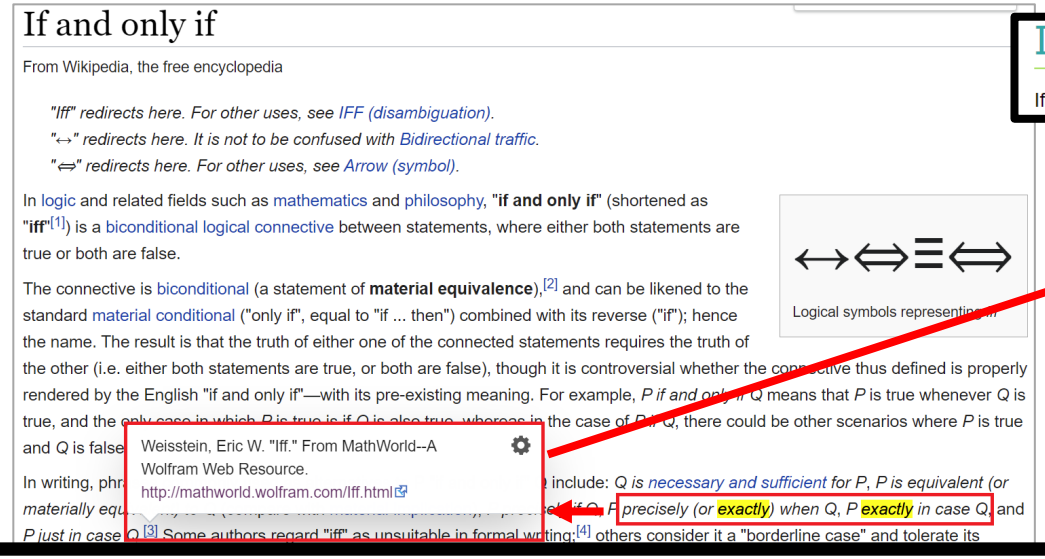
In logic and related fields such as mathematics and philosophy, "**if and only if**" (shortened as "**iff**"[1]) is a biconditional logical connective between statements, where either both statements are true or both are false.

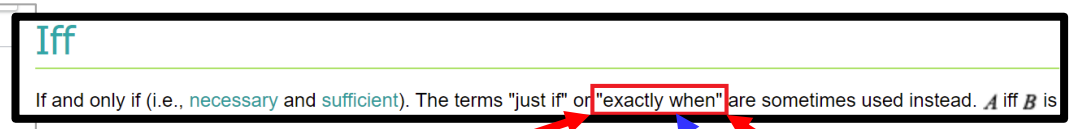
Logical symbols representing *iff*

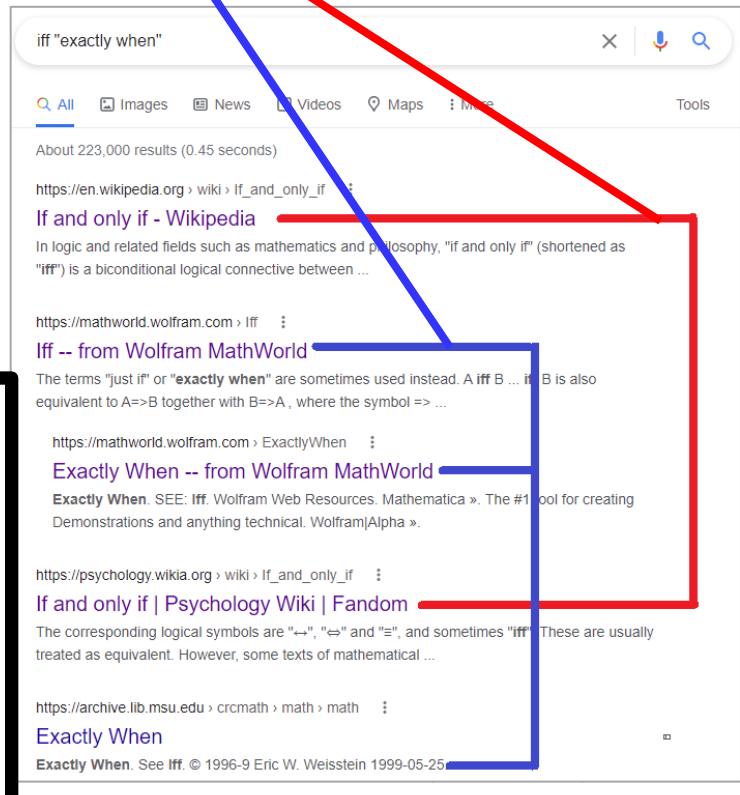
The connective is biconditional (a statement of **material equivalence**),[2] and can be likened to the standard material conditional ("only if", equal to "if ... then") combined with its reverse ("if"); hence the name. The result is that the truth of either one of the connected statements requires the truth of the other (i.e. either both statements are true, or both are false), though it is controversial whether the connective thus defined is properly rendered by the English "if and only if"—with its pre-existing meaning. For example, *P if and only if Q* means that *P* is true whenever *Q* is true, and the only case in which *P* is true is if *Q* is also true, whereas in the case of *P if Q*, there could be other scenarios where *P* is true and *Q* is false.

Weisstein, Eric W. "Iff." From MathWorld--A Wolfram Web Resource.
http://mathworld.wolfram.com/Iff.html

In writing, phr include: *Q is necessary and sufficient for P*, *P is equivalent (or materially equ ly if Q*, *P precisely (or exactly) when Q*, *P exactly in case Q*, and *P just in case Q*.[3] Some authors regard "iff" as unsuitable in formal wr ting;[4] others consider it a "borderline case" and tolerate its







<u>"Exactly when" sometimes means "iff" but:</u>

(1) none of the top sources explain why

(2) all of the top sources either cite Weisstein's MathWorld or ***are*** Mathworld

(3) MathWorld redirects "exactly when" to "iff" (i.e. "exactly when" is less significant)

(4) **Above sources prefer: "P iff Q", "P is equivalent to Q", "P just if Q" or "P is N&C for Q"**

(5) there's not very many other sources using "exactly when" in this way

(6) etc.

If A then B. (A => B)

A if B. (B => A)

- Two different meanings of the word “if” !!! Confusing!

In logic and related fields such as mathematics and philosophy, "**if and only if**" (shortened as "**iff**"[1]) is a biconditional logical connective between statements, where either both statements are true or both are false.

Logical symbols representing *iff*

The connective is biconditional (a statement of **material equivalence**),[2] and can be likened to the standard material conditional ("only if", equal to "if ... then") combined with its reverse ("if"); hence the name. The result is that the truth of either one of the connected statements requires the truth of the other (i.e. either both statements are true, or both are false), though it is controversial whether the connective thus defined is properly rendered by the English "if and only if"—with its pre-existing meaning. For example, *P if and only if Q* means that *P* is true whenever *Q* is true, and the only case in which *P* is true is if *Q* is also true, whereas in the case of *P if Q*, there could be other scenarios where *P* is true and *Q* is false.

If it helps:

Don’t consider **iff** to be an English term

Mathematically: A => B and B=> A (A <=> B)

Treat ***"if and only if"*** as a short form

If A then B ***and*** only if B

If A then B ***and*** only if B then A

It has a maximum and/or a minimum

English “or” = Exclusive OR (XOR)

- A and B have to be different (one true and the other false) for A XOR B to be true

MATH 135 “or” = Inclusive OR

- Only one of A or B has to be true for A V B to be true.

Review

- If the hypothesis A is false, is B true?

- No! Only (A => B) is true!

Hypothesis FALSE, but Conclusion also FALSE

Hypothesis (A) Conclusion (B)

$$\forall x \in \mathbb{R}, ((x > 2) \Rightarrow (x^2 \geq 4)).$$

Implication always TRUE if Hypothesis is FALSE

Implication (A => B)

x	$x > 2$	$x^2 \geq 4$	$(x > 2) \Rightarrow (x^2 \geq 4)$
$x > 2$	T	T	T
$x = 2$	F	T	T
$-2 < x < 2$	F	F	T
$x \leq -2$	F	T	T

- We will use the convention that (A => B) is ***true*** if A is ***false***. In this case we say it's "***vacuously true***".
- This way we don't have to spend time checking cases that ***do not impact*** the open sentence.

- This convention *might* not be followed in some types of non-classical logic (click for link to Wikipedia page!).