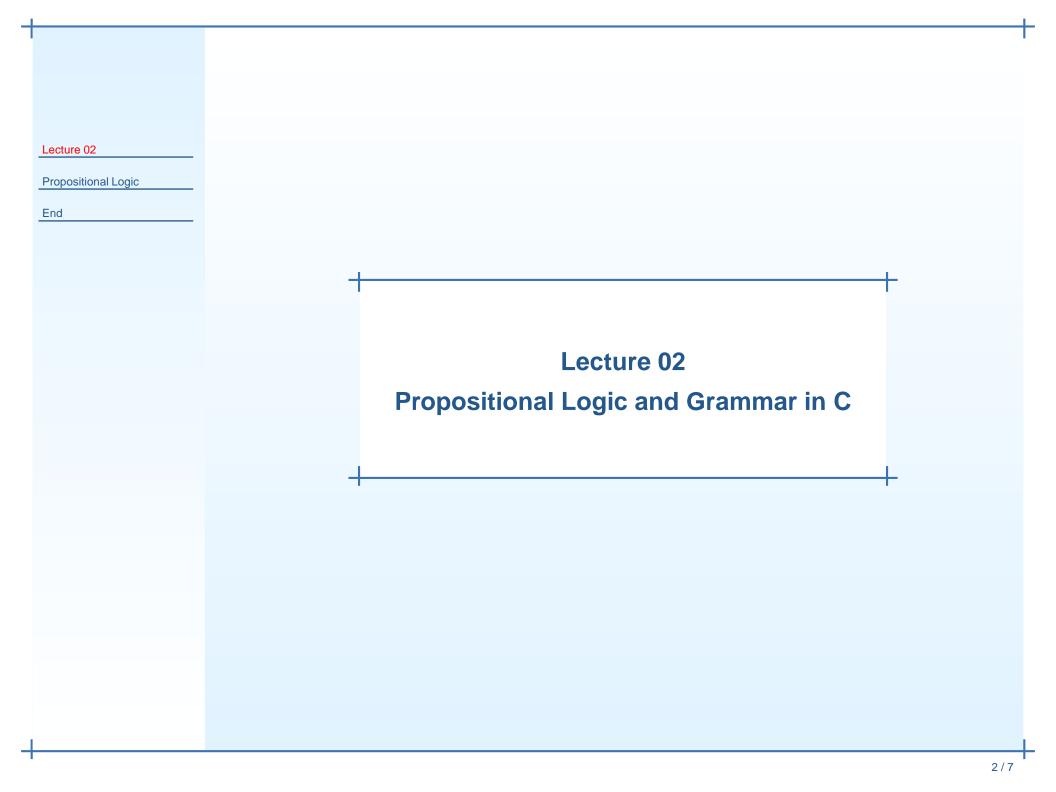
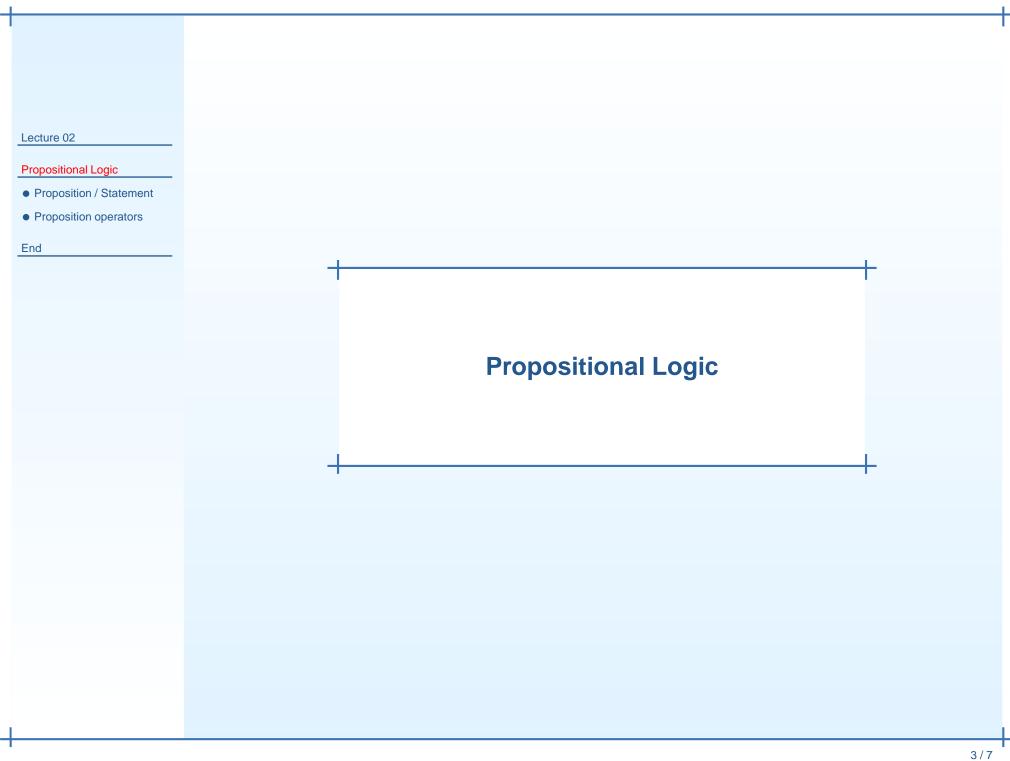
HKOI Training

 $ami \sim wkc$

Last modified: March 3, 2010





Lecture 02

Propositional Logic

- Proposition / Statement
- Proposition operators

End

A statement / proposition is a sentence that has either an answer, "Yes" or "No".1

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A statement / proposition is a sentence that has either an answer, "Yes" or "No".1

For example, all the following are proposition.²

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End

A *statement / proposition* is a sentence that has either an answer, "Yes" or "No". ¹ For example, all the following are proposition. ²

• Today is hot.

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End

- Today is hot.
- I will not go to school.

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End

- Today is hot.
- I will not go to school.
- $1+2+3=\frac{1}{2}(3)(4)$.

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- Today is hot.
- I will not go to school.
- $1+2+3=\frac{1}{2}(3)(4)$. (Yes)

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- Today is hot.
- I will not go to school.
- $1+2+3=\frac{1}{2}(3)(4)$. (Yes)
- There are infinitely many prime numbers.

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End

- Today is hot.
- I will not go to school.
- $1+2+3=\frac{1}{2}(3)(4)$. (Yes)
- There are infinitely many prime numbers. (Yes)

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- Today is hot.
- I will not go to school.
- $1+2+3=\frac{1}{2}(3)(4)$. (Yes)
- There are infinitely many prime numbers. (Yes)

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- Today is hot.
- I will not go to school.
- $1+2+3=\frac{1}{2}(3)(4)$. (Yes)
- There are infinitely many prime numbers. (Yes)
- $\left(\sqrt{x^2}\right)^2 = x$. (No, it is false when x is negative.)

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End

- Today is hot.
- I will not go to school.
- $1+2+3=\frac{1}{2}(3)(4)$. (Yes)
- There are infinitely many prime numbers. (Yes)
- $\left(\sqrt{x^2}\right)^2 = x$. (No, it is false when x is negative.)
- If n is a 5-digit square integer, then n = 29929.

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- Today is hot.
- I will not go to school.
- $1+2+3=\frac{1}{2}(3)(4)$. (Yes)
- There are infinitely many prime numbers. (Yes)
- $\left(\sqrt{x^2}\right)^2 = x$. (No, it is false when x is negative.)
- If n is a 5-digit square integer, then n = 29929. (Yes)
- $\bullet \ \ x=2 \text{ only if } x^2=4.$

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- Today is hot.
- I will not go to school.
- $1+2+3=\frac{1}{2}(3)(4)$. (Yes)
- There are infinitely many prime numbers. (Yes)
- $\left(\sqrt{x^2}\right)^2 = x$. (No, it is false when x is negative.)
- If n is a 5-digit square integer, then n = 29929. (Yes)
- x = 2 only if $x^2 = 4$. (Yes)
- x = 2 if $x^2 = 4$.

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End

- Today is hot.
- I will not go to school.
- $1+2+3=\frac{1}{2}(3)(4)$. (Yes)
- There are infinitely many prime numbers. (Yes)
- $\left(\sqrt{x^2}\right)^2 = x$. (No, it is false when x is negative.)
- If n is a 5-digit square integer, then n = 29929. (Yes)
- x = 2 only if $x^2 = 4$. (Yes)
- x = 2 if $x^2 = 4$. (No)
- n=2 and n is a prime.

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End

- Today is hot.
- I will not go to school.
- $1+2+3=\frac{1}{2}(3)(4)$. (Yes)
- There are infinitely many prime numbers. (Yes)
- $\left(\sqrt{x^2}\right)^2 = x$. (No, it is false when x is negative.)
- If n is a 5-digit square integer, then n = 29929. (Yes)
- x = 2 only if $x^2 = 4$. (Yes)
- x = 2 if $x^2 = 4$. (No)
- n=2 and n is a prime. (Yes)

¹We skip a bit by using "common sense" to determine whether a sentence is a proposition or not.

 $^{^{2}}$ To emphasize that we are not solving equation, we interpret the = sign to be "always equal".

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End

The following are not propositions or we won't discuss the following kind of sentences.

• What time is it now?

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- What time is it now?

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End

- What time is it now?
- (empty string)³

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End

- What time is it now?
- (empty string)³
- This statement is false.

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- What time is it now?
- (empty string)³
- This statement is false.
- I am lying. ⁴

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- What time is it now?
- (empty string)³
- This statement is false.
- I am lying. ⁴
- The second unique child of God is a female.

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End

The following are not propositions or we won't discuss the following kind of sentences.

- What time is it now?
- (empty string)³
- This statement is false.
- I am lying. 4
- The second unique child of God is a female.

Actually, some of them can be considered as statements.

However, for simplicity, we shall avoid them at this moment.

 $^{^3}$ This is usually called the ϵ -string

⁴The Liar paradox

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Given some propositions, we can construct another proposition from them.

• What time is it now?

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- What time is it now?

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End

- What time is it now?
- (empty sentence)

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- What time is it now?
- (empty sentence)
- This statement is false.

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- What time is it now?
- (empty sentence)
- This statement is false.
- I am lying.

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- What time is it now?
- (empty sentence)
- This statement is false.
- I am lying.
- The second unique child of God is a female.

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- What time is it now?
- (empty sentence)
- This statement is false.
- I am lying.
- The second unique child of God is a female.

