CSE215
Foundations of Computer Science

Instructor: Zhoulai Fu

State University of New York, Korea

Today

- Revision on validity
- Revision on predicates

Revision on validity

Some of the arguments in 24–32 are valid, whereas others exhibit the converse or the inverse error. Use symbols to write the logical form of each argument. If the argument is valid, identify the rule of inference that guarantees its validity. Otherwise, state whether the converse or the inverse error is made.

24. If Jules solved this problem correctly, then Jules obtained the answer 2.
Jules obtained the answer 2.
$\therefore$ Jules solved this problem correctly.

25. This real number is rational or it is irrational.
This real number is not rational.
$\therefore$ This real number is irrational.

26. If I go to the movies, I won't finish my homework. If I don't finish my homework, I won't do well on the exam tomorrow.

∴ If I go to the movies, I won't do well on the exam tomorrow.

27. If this number is larger than 2, then its square is larger than 4.

This number is not larger than 2.

$\therefore$ The square of this number is not larger than 4.

30. If this computer program is correct, then it produces the correct output when run with the test data my teacher gave me.
This computer program produces the correct output when run with the test data my teacher gave me.
$\therefore$ This computer program is correct.

In 41–44 a set of premises and a conclusion are given. Use the valid argument forms listed in Table 2.3.1 to deduce the conclusion from the premises, giving a reason for each step as in Example 2.3.8. Assume all variables are statement variables.

41. a. $\sim p \vee q \to r$

b. $s \vee \sim q$

c. $\sim t$

d. $p \to t$

e. $\sim p \wedge r \to \sim s$

f. $\therefore \sim q$

42. a. $p \vee q$

b. $q \to r$

c. $p \wedge s \to t$

d. $\sim r$

e. $\sim q \to u \wedge s$

f. $\therefore t$

Revision on predicates

A commonly used notational equivalence

Example: All doctors wear glasses

- for all doctor d, d wears glasses
- for all d, if d is a doctor, then d wears glasses
- Formally, if we define
  - D to be the set of doctors,
  - wear_glass to be a function that takes a person x as an input, and returns true if x wears glasses
- then the following two statements are considered the same

$$\forall d \in D, \texttt{wear\_glass}(d).$$

$$\forall d, d \in D \to \texttt{wear\_glass}(d)$$

Exercise: Translate to formal logic

- Given:
  - S: set of students
  - P(s): s passed the exam.
  - W(s): s worked hard.
  - C(s): s is in Professor Cho’s class.
- **Every student in Professor Cho’s class passed the exam**

Exercise: Translate to formal logic

- Given:
    - S: set of students
    - P(s): s passed the exam.
    - W(s): s worked hard.
    - C(s): s is in Professor Cho’s class.
- **Some students studied hard but did not pass the exam**

Exercise: Translate to formal logic

- Given:
    - S: set of students
    - P(s): s passed the exam.
    - W(s): s worked hard.
    - C(s): s is in Professor Cho's class.
- **There are students who did not study hard but passed the exam**

Exercise: Translate to formal logic

- Given:
  - S: set of students
  - P(s): s passed the exam.
  - W(s): s worked hard.
  - C(s): s is in Professor Cho’s class.
- **All students who studied hard passed the exam.**

Exercise: Translate to formal logic

- Given:
    - S: set of students
    - P(s): s passed the exam.
    - W(s): s worked hard.
    - C(s): s is in Professor Cho’s class.
- **No student in Professor Cho’s class failed the exam.**

Exercise: Translate to formal logic

- Given:
    - S: set of students
    - P(s): s passed the exam.
    - W(s): s worked hard.
    - C(s): s is in Professor Cho’s class.
- **There are no students in Professor Cho’s class who did not study hard but still passed the exam.**

Exercise: Translate to formal logic

- Given:
    - L: set of locks
    - K set of keys
    - unlock (k,l): k can unlock l
- **Some keys cannot unlock any lock.**