

Exercise walk-through

4.4

Interfaces and polymorphism

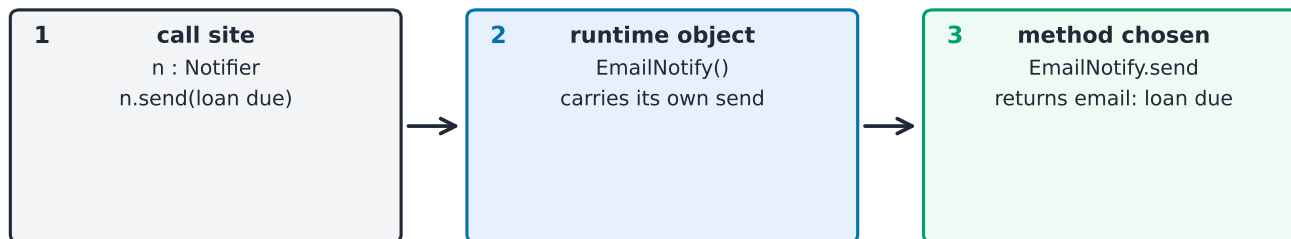
University Computer Science

Interfaces and polymorphism: one call, many behaviours

- 1 **Contract Duck typing** accepts any object with the right methods; a protocol writes the contract down without forcing **inheritance**.
- 2 **Dispatch** One loop over three senders prints email, sms and queue lines - the call site never learns the concrete classes.
- 3 **Substitute** A substitute must accept at least what the **interface** promises and break no promise: preconditions only widen, guarantees only grow.

Dynamic dispatch sequence

one call, three steps, one winner



the annotation names the interface — the object decides the method; swap in SmsNotify and only step 2 and 3 change

One call, three steps: the variable names the **interface**, the object carries the runtime type, dispatch picks the send of that type.

Exercises 2.1-2.2

2.1 A variable holds an `SmsNotify` and the call `send` runs. State which method executes and what chose it. [3]

2.2 A fourth sender class is added. State what changes in the existing loop body. [3]

Exercises 2.1·2.2

2.1 A variable holds an `SmsNotify` and the call `send` runs. State which method executes and what chose it. [3]

2.1

- `SmsNotify.send` executes ✓.
- The runtime type – the object the variable holds – chose it ✓.

2.2 A fourth sender class is added. State what changes in the existing loop body. [3]

2.2

- Nothing – no existing line changes ✓.
- The new class provides `send`; the list gains one entry ✓.

Exercise 2.3

2.3 Classify each move as widening or narrowing: accepting an empty string; raising on an empty string. [3]

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2.3

- Accepting an empty string: widening (legal) ✓.
- Raising on it: narrowing (illegal) ✓.

Exercise 3.1

3.1 A reminder system holds a list of notifiers and runs one loop: `for n in team: print(n.send('loan due'))`. The list holds an email sender returning `email: loan due`, an SMS sender returning `sms: loan due`, and a queue sender returning `queue: loan due`.

Write the three lines the loop prints. Explain, in order, what the variable names, what the object carries, and what dispatch picks – naming the rule that decides. State what edits the call site needs when a fourth sender joins the list. [8]

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3.1

- `email: loan due, sms: loan due, queue: loan due ✓`.
- The variable names the interface; the object carries the runtime type; dispatch picks that type's method ✓.
- The deciding rule: attribute lookup resolves on the runtime type – dynamic dispatch ✓.
- No edits: open to new types, closed to edit – the list gains an entry, the call site stands ✓.

Exercise 3.2

3.2 A substitute `SilentNotify.send` raises when the text is empty, while the interface promises that `send` never raises and always returns a string.

Name the rule the substitute breaks and the direction preconditions may legally move. State what a caller relying on the promise now suffers. Write the contract fix – what the substitute must accept and still return – and name what an `isinstance` chain should be replaced with.

[7]

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3.2

- Breaks substitution ✓.
- Preconditions may only widen ✓.
- The caller, told `send` never raises, now crashes on the empty text ✓.
- Fix: accept at least the promised inputs (including empty) and still return a string – e.g. return a skip marker ✓.
- Replace the `isinstance` chain with a method each class implements – dispatch is the chain's replacement ✓.