

Solution 5: Assignments and control structures

ETH Zurich

1 Assignments

The solution lists the correct statements for each of the subtasks.

1. (c)
2. (a)
3. (b)
4. (d)
5. (c)
6. (d) (e)
7. (a)
8. (c) (e)
9. (b) (e)

2 Reading loops

Version A:

- The result of the comparison using `=` will always be **False** (*STRING* is a reference type).
- The second if-statement is inside the loop, so it will try to move “Central” in every loop iteration after it had been found. This behavior is not incorrect, as it has no effect expect for the first time, but it is inefficient.
- The corrected code of version A is shown in Listing 1.

Version B:

- Infinite loop: there is no call to a command that advances the cursor position in the list.
- Possible precondition violation: *i.item.name* `~` “**Central**” will most likely be tested before *i.after*, therefore trying to access an item when the cursor has already advanced past the end of the list. To get a guaranteed correct order of evaluation, switch the two conditions and use **or else** instead of **or**.
- The corrected code of version B is shown in Listing 2.

Listing 1: Version A

```
explore
  -- Move "Central".
  local
    station: STATION
  do
    across
      Zurich.stations as i
    loop
      if i.item.name ~ "Central" then
        station := i.item
      end
    end
  end
  if station /= Void then
    station.set_position ([0.0, 0.0])
  end
end
```

Listing 2: Version B

```
explore
  -- Move "Central".
  local
    i: like Zurich.stations.new_cursor
  do
    from
      i := Zurich.stations.new_cursor
    until
      i.after or else i.item.name ~ "Central"
    loop
      i.forth
    end
  end
  if not i.after then
    i.item.set_position ([0.0, 0.0])
  end
end
```

3 Next station: loops

note

description: "Route information displays."

class

DISPLAY

inherit

ZURICH_OBJECTS

feature -- Explore Zurich

add_public_transport

-- Add a public transportation unit per line.

```
do
  across
    Zurich.lines as i
  loop
    i.item.add_transport
  end
end
```

update_transport_display (t: *PUBLIC_TRANSPORT*)

-- Update route information display inside transportation unit 't'.

```
require
  t.exists: t /= Void
local
  i: INTEGER
  s: STATION
```

```

do
  console.clear
  console.append_line (t.line.number.out + " Willkommen/Welcome")
from
  i := 1
  s := t.arriving
until
  i > 3 or s = Void
loop
  console.append_line (stop_info (t, s))
  s := t.line.next_station (s, t.destination)
  i := i + 1
end
if s /= Void then
  if s /= t.destination then
    console.append_line ("...")
  end
  console.append_line (stop_info (t, t.destination))
end
end

stop_info (t: PUBLIC_TRANSPORT; s: STATION): STRING
-- Information about stop 's' of transportation unit 't'.
require
  t_exists: t /= Void
  s_on_line: t.line.has_station (s)
local
  time_min: INTEGER
  l: LINE
do
  time_min := t.time_to_station (s) // 60
  if time_min = 0 then
    Result := "<1"
  else
    Result := time_min.out
  end
  Result := Result + " Min.%T" + s.name

  -- Optional task:
  across
    s.lines as i
  loop
    l := i.item
    if l /= t.line and
      ((l.next_station (s, l.first) /= Void and not
        t.line.has_station (l.next_station (s, l.first))) or
      (l.next_station (s, l.last) /= Void and not
        t.line.has_station (l.next_station (s, l.last)))) then
      Result := Result + " " + i.item.number.out
    end
  end
end
end
end

```

end

4 Board game: Part 1

There are several possible solutions; we discuss the two most reasonable in our opinion.

The simpler solution only includes three classes:

- *GAME*: encapsulates the logic of the game (start state, the structure of a round, ending conditions).
- *DIE*: provides random numbers in the required range.
- *PLAYER*: stores the state of each player in the game and performs a turn.

We discarded *ROUND* and *TURN*: we consider them parts of the *GAME* and *PLAYER* behavior respectively, rather than separate abstractions. Additionally *PLAYER* and *TOKEN* represent the same abstraction for now.

In the simple solution we don't introduce classes for *SQUARE* and *BOARD*. The only information associated with squares in the current version of the game is their index, thus a square can be easily represented with an integer. Also the board in the current version doesn't have any specific structure (square arrangement); the only property of the board is the number of squares, which probably does not deserve a separate class and instead can be stored in *GAME*.

A more flexible solution additionally includes classes *SQUARE* and *BOARD*. Though *SQUARE* doesn't contain enough behavior for now, we anticipate that in the future versions of the game there might be squares with special properties and behavior (this anticipation is based on our knowledge of the problem domain, namely that interesting boardgames have squares of different types with different properties).

Introducing class *BOARD* makes the solution more flexible with respect to the arrangement of squares on the board. In the simple version the knowledge about "on which square does a token land if it moves n steps starting from square x " is located in class *PLAYER*. Once it becomes more complicated than just $x + n$, it is better to encapsulate such knowledge in class *BOARD*.