Usability Studies

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Today

- Think-aloud usability studies: a way to gather ground truth about challenges people face when using your software
- Additional resource: https://www.nngroup.com/articles/usability-testing-101/
- Brief Agile introduction (more on Monday)

A TOUR OF QUALITATIVE METHODS

- Data sources
  - Interviews and focus groups
  - **Usability studies**
  - Surveys
  - Contextual inquiry
  - Corpus studies

- Analytic approaches
  - Thematic analysis
  - (others)

INTERVIEWS AND FOCUS GROUPS

- Method: make a list of questions. Ask them 1-1 or to a group.
- Useful when you want to learn from experts
- Results depend on interview skill and quality of participants

USABILITY STUDIES

- Method: ask participants to do tasks with a system. Observe what problems they have.
- RQ: "What challenges do users have when they do X?"
- Great for iterating on designs
- Depends on availability of suitable users and tasks

SURVEYS

- Useful for gathering data from many people
- Not great for depth

CONTEXTUAL INQUIRY

- Watch someone doing a task
- Depends on finding an expert

CORPUS STUDIES

- RQ: "How often does X occur in the wild?"
  - or: "Does X ever occur in the wild?"
- e.g., X = null pointer dereference bugs
- e.g., X = harassment of open-source contributors
- Requires an X detector (maybe manual analysis) and a corpus

ANALYSIS

- Many qualitative studies produce textual data
  - Interview transcripts
  - Bug reports
  - Code snippets
  - Images
- Can we do better than "I read it and it seems to me…"?

IN PRACTICE

- Industrial user studies are usually informal.
- Not trying to produce generalizable results or convince others.
- But I'm going to hint at a more structured way anyway.

OPEN-CODE THE DATA

- Meaning: categorize each element
- Manual process
- Can parallelize (have multiple coders)
    - Then have to worry about consistency
- Now you have categories!

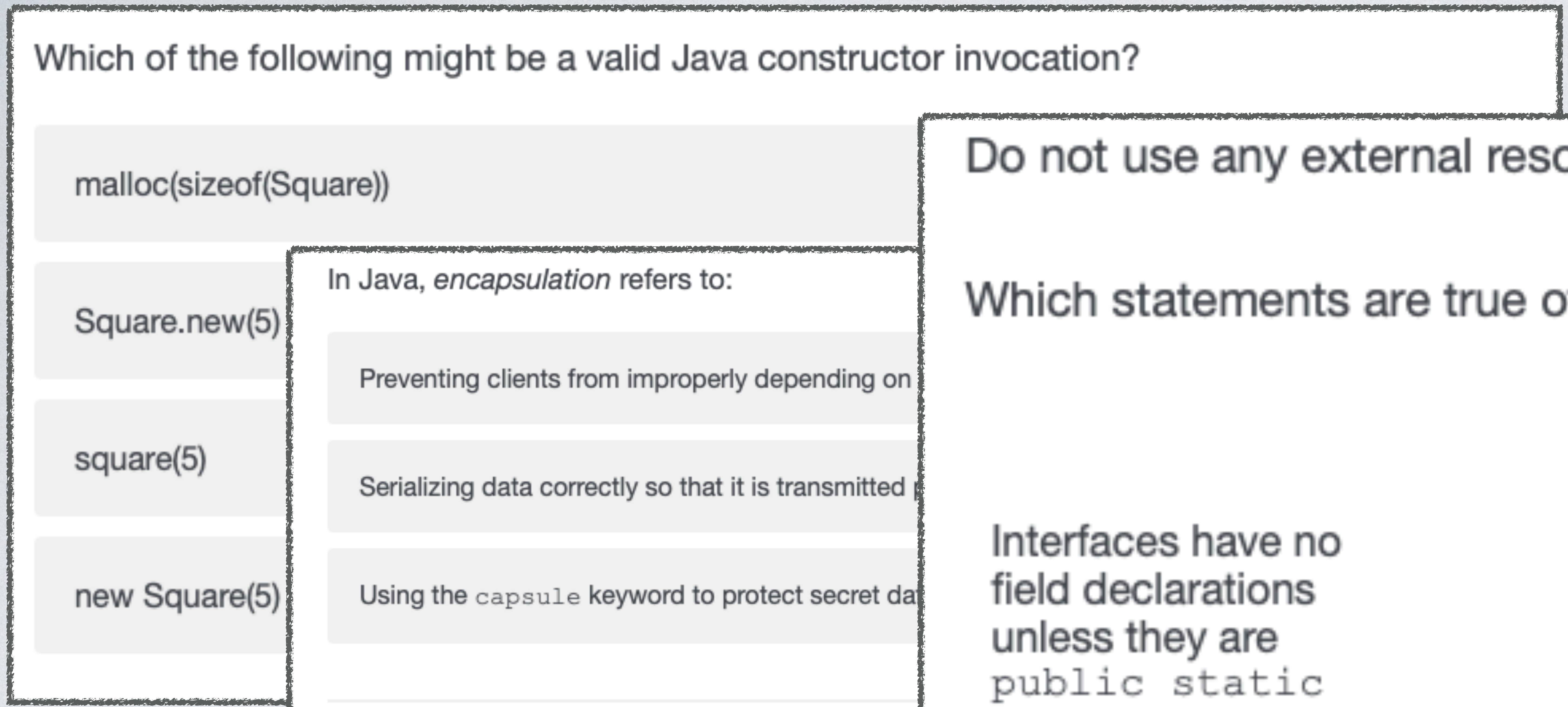
Running Studies

STUDY DESIGN OVERVIEW

- Running studies requires:
  - If *research* study: ethics approval (but this is not a research class)
  - Recruiting
  - Training
  - Task design
  - Data collection/analysis

PARTICIPANT PRE-SCREENING

- Can issue a pre-test to avoid wasting time on unqualified participants.
- How will you incentivize people to take the test?



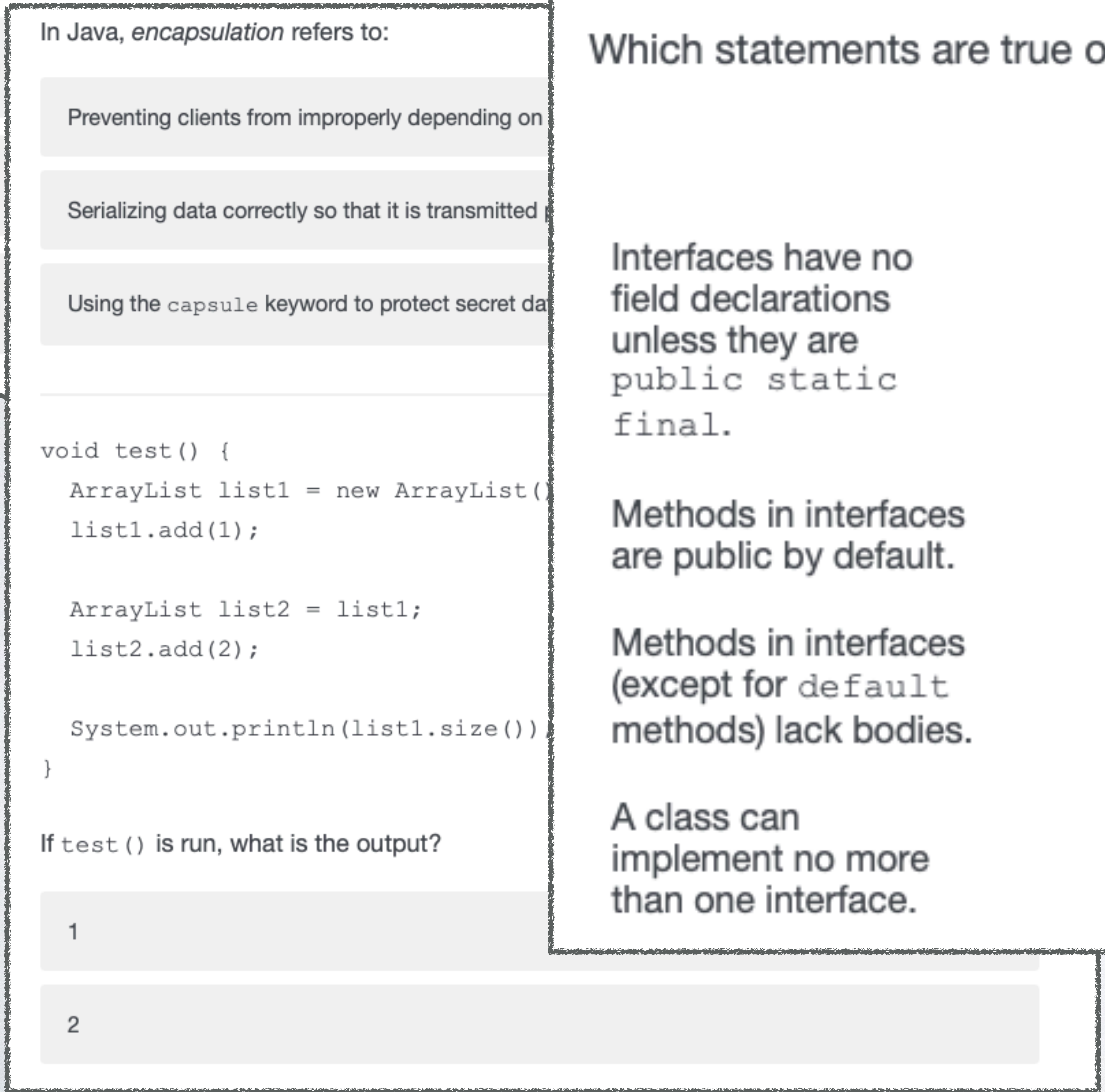
Which of the following might be a valid Java constructor invocation?

malloc(sizeof(Square))

Square.new(5)

square(5)

new Square(5)



In Java, *encapsulation* refers to:

Preventing clients from improperly depending on

Serializing data correctly so that it is transmitted

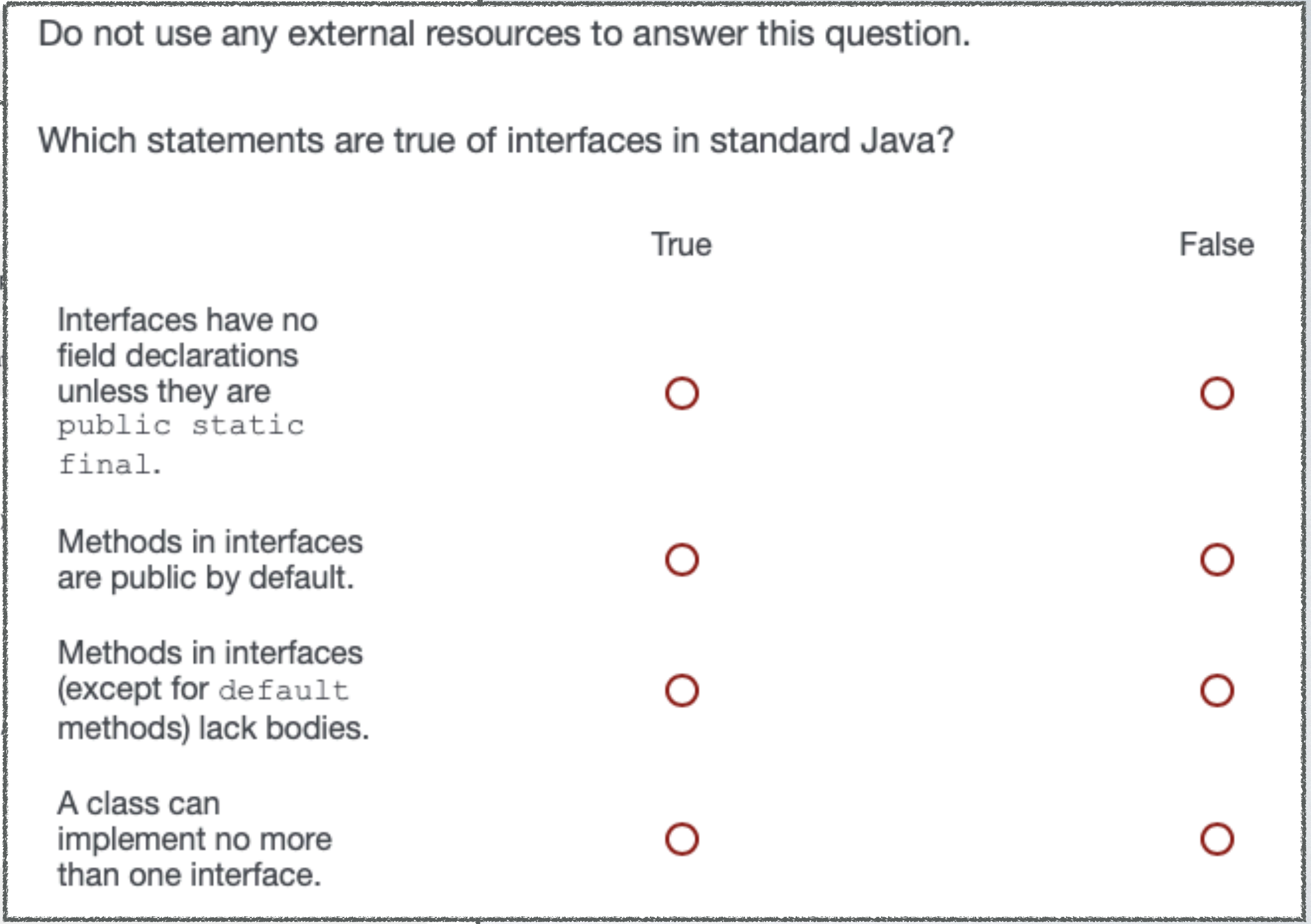
Using the `capsule` keyword to protect secret da

```
void test() {
  ArrayList list1 = new ArrayList()
  list1.add(1);

  ArrayList list2 = list1;
  list2.add(2);

  System.out.println(list1.size())
}
```

If `test()` is run, what is the output?

1

2



Do not use any external resources to answer this question.

Which statements are true of interfaces in standard Java?

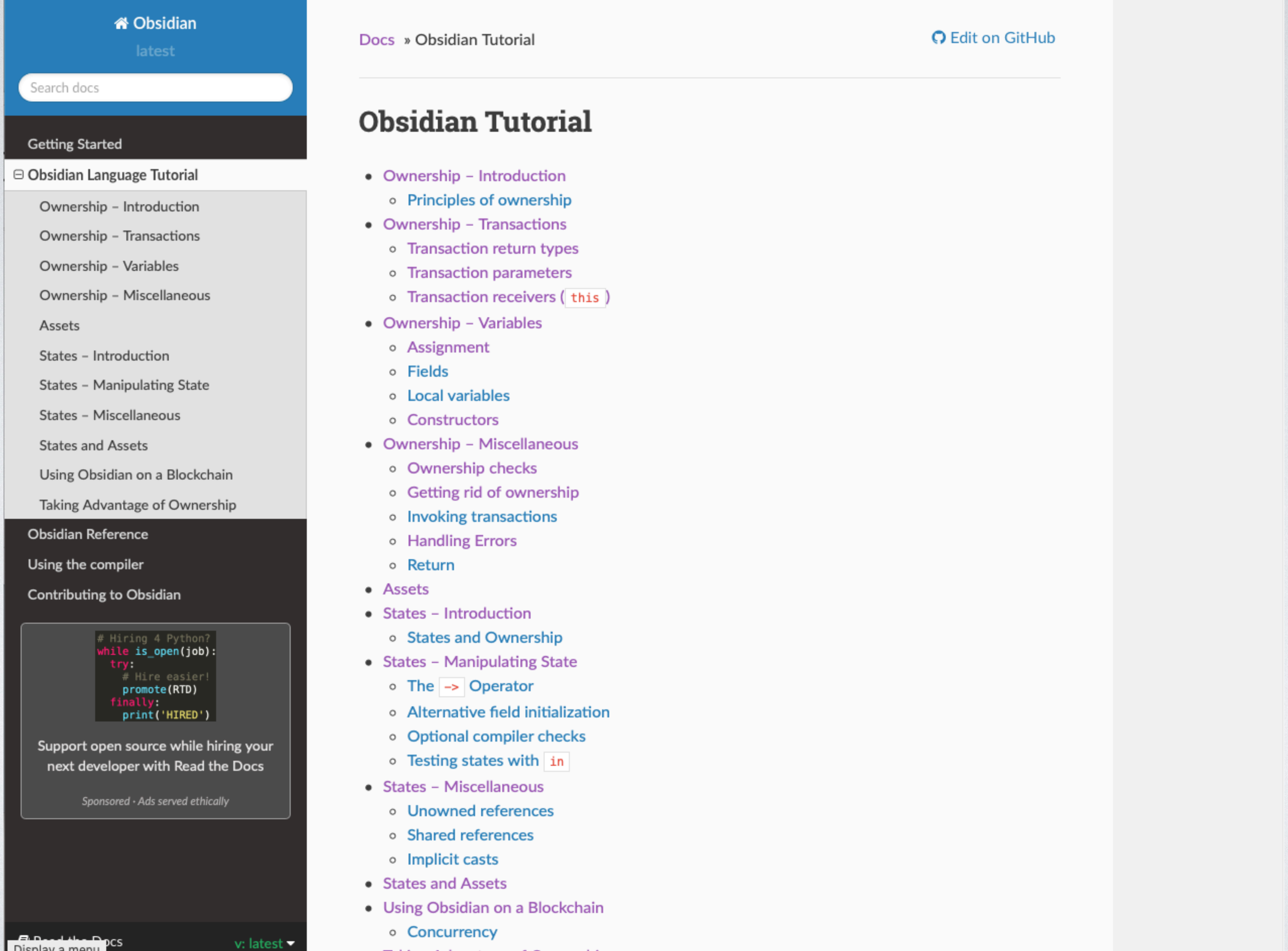
	True	False
Interfaces have no field declarations unless they are `public static final`.	○	○
Methods in interfaces are public by default.	○	○
Methods in interfaces (except for `default` methods) lack bodies.	○	○
A class can implement no more than one interface.	○	○

DEMOGRAPHICS

- Collect information if you want it!
- Age? Gender? Experience?

TRAINING

- How will you prepare your participants?
- People don't read.
- People think they understand but in fact do not.
- Teach…and then assess.
- Or: decide that no training is necessary.



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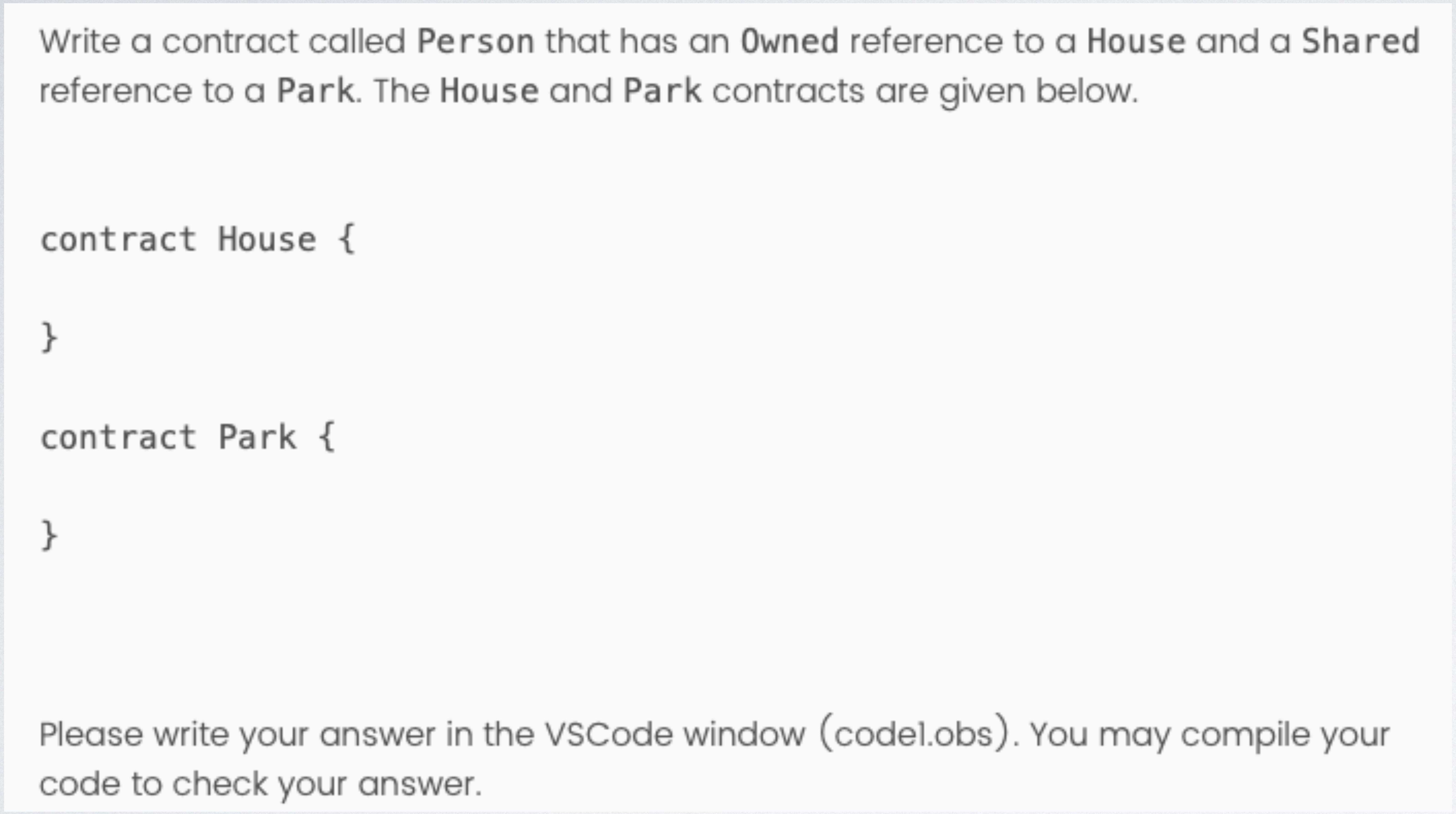
Obsidian Tutorial



Write a contract called **Person** that has an **Owned** reference to a **House** and a **Shared** reference to a **Park**. The **House** and **Park** contracts are given below.

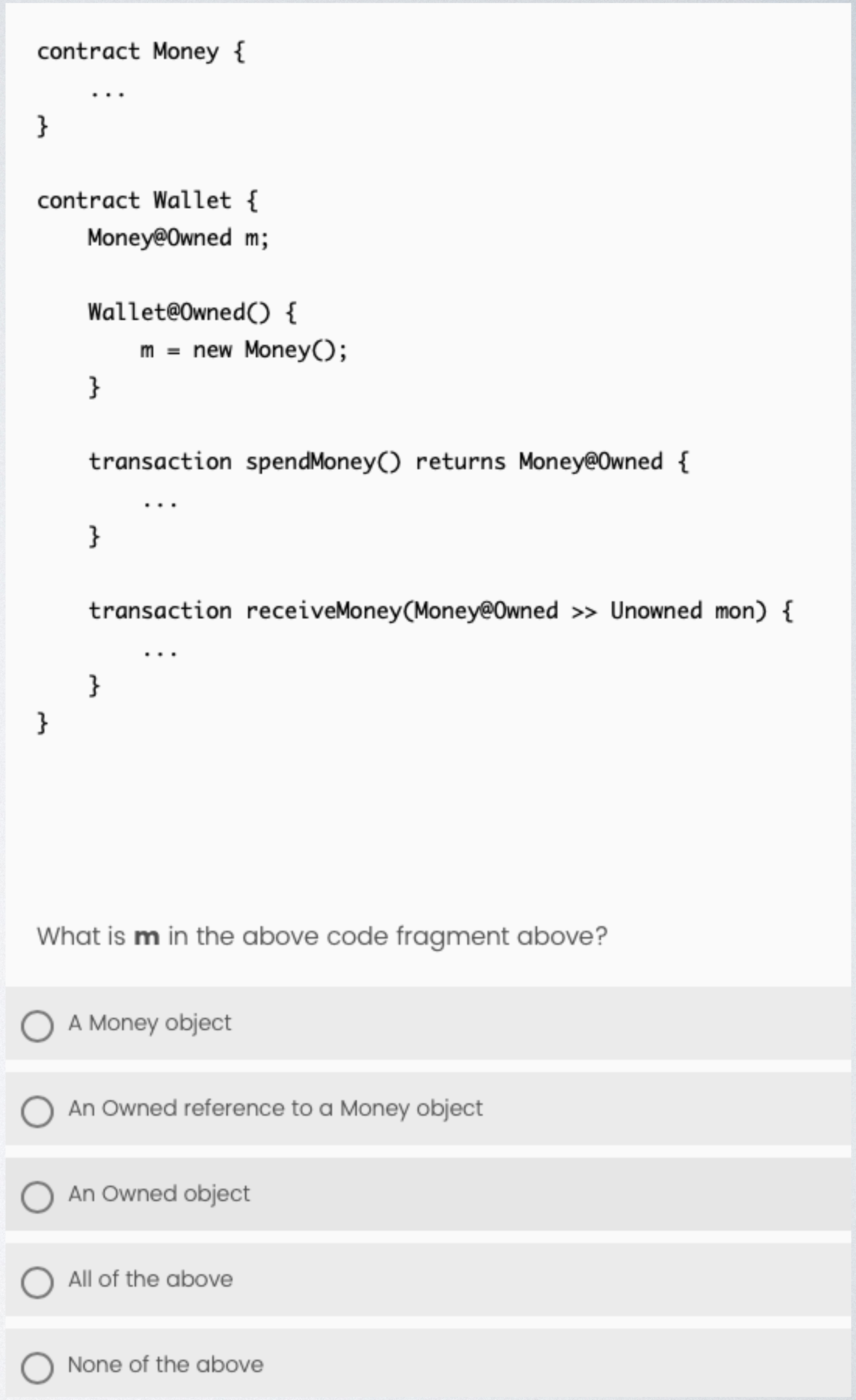
```
contract House {

}

contract Park {

}
```

Please write your answer in the VSCode window (code1.obs). You may compile your code to check your answer.



```
contract Money {
    ...
}

contract Wallet {
    Money@Owned m;

    Wallet@Owned() {
        m = new Money();
    }

    transaction spendMoney() returns Money@Owned {
        ...
    }

    transaction receiveMoney(Money@Owned >> Unowned mon) {
        ...
    }
}
```

What is **m** in the above code fragment above?

- ○ A Money object
- ○ An Owned reference to a Money object
- ○ An Owned object
- ○ All of the above
- ○ None of the above

RECRUITMENT

- Flyers
- Emails
- Social network
- Buy ads
- The street

See: Report from Dagstuhl Seminar 19231 Empirical Evaluation of Secure Development Processes

INCENTIVES

- $$$ (in person, MTurk)
- Desire to contribute to science / help you out
- Food
- Fame (leaderboard)
- Rare experience
- Learning opportunity
- Distraction from work
- Credit

THINK-ALOUD USABILITY STUDIES

- Give people tasks and observe what happens.
- NOT experiments
- NOT comparative
- Just want to see what problems people encounter.
- Follow "think-aloud" protocol

USABILITY STUDIES CAN SHOW

- Participants encountered the following problems…
- Participants were confused by…
- Only participants who knew X were able to do the task.

USABILITY STUDIES CANNOT SHOW

- My system is better than an existing system.

USABILITY STUDY TASKS

- Choose an *interesting* task
  - One that you think might be hard
  - One that is central to the usability of your design
- Can't test everything

WHY TASKS?

- Opinions are often not convincing
- Hypothetical questions are especially unconvincing
- Need to see what *actually happens* when users do *realistic tasks*

TASKS

- This is the hardest part of study design.
- You will not get this right the first time.
- Solution: pilot repeatedly.
- What is the distribution over task times?

TASK IDEAS

- Write a program according to this specification.
- Are there bugs in this code? If so, what are they?
- Fill in the missing code…
- What does this code do?
- Answer these questions about this code.

TASK DESIGN

- Must carefully restrict tasks!
- People will get stuck on irrelevant things
- Decide how much help to provide
- Ideally: scope task to focus on the variable of interest
- *Constrain the task as much as possible.*

DATA COLLECTION

- Think-aloud
- Audio recordings
- Videos
- Screen capture
- Eye tracking
- Post-study survey

- Take lots of notes!, including timestamps! You do not want to watch the videos.
- Include a clock on the screen.

THINK-ALOUD

- Two varieties: concurrent and retrospective
- "Please keep talking."
- Can't use timing as a dependent variable due to effect of explanations.

TASK CONTEXTS

- Pencil/paper
- Text editor
- IDE

- Compiler?
- Debugger?
- Test cases?

YOUR TURN

- You are interested in studying challenges that users have when using the Gmail web app.
- Design tasks that you will give your participants in a 30-minute study.

CONCLUSION

- Running usability studies requires:
  - Recruiting
  - Training
  - Task design
  - Data collection/analysis
- Task design is probably the trickiest. Start early and pilot!

Prep for Next Time: Agile

Agile Overview

- Keep a *prioritized* list of user stories in a **backlog**
- The **product owner** sets priorities of backlog items
- Divide work into **sprints** (often, two weeks long)
- Conceptually: at end of each sprint, you could ship
- The **scrum master** keeps the process on track
  - Removes barriers to success

Sprint Structure

- Start with a **planning meeting**
    - First, **estimate** user stories
    - Then, **commit** to user stories individually
- Every day: **standup meeting**
    - What did I do yesterday?
    - What will I do today?
    - Am I stuck?
- Then: **sprint review** and **sprint retrospective**

Sprint Review

- For each user story: demo!
- If acceptance criteria achieved, great.
    - Otherwise, user story goes back on the backlog.

Sprint Retrospective

- Discuss how the sprint went
- Refine interactions, processes, tools
- Identify and solve problems
- Decide on changes to improve effectiveness