Note-taking Tips

- For each problem, write on your copy:
    - Write start time, end time of work, end time of recall.
        - E.g. 1:10 - 1:14 - 1:16
    - Write step by step instructions of their strategy
        - Note any deviations from line by line tracing (most common strategy)
    - Identify reason for errors. Common reasons for errors:
        - **Scope** (same variable name in different methods)
        - **Return vs println** (returned value is thought to be printed)
        - **Method returns not being stored** (return value is returned but not stored)
        - **Variable updates** (lost track of what variable value is)
        - **Math mistakes** (misunderstood how to use mod)
        - **Mistakes from shortcutting steps** (skipped executing a method b/c return value wasn't stored)
    - Note anything they write down to show intermediate steps (e.g. writing variable values inline, making a table)

Study Date: _____ Real Start Time: _____ Location: _____ Strategy: Yes / No

Participant's First Name + Last Initial: _____ Interviewer: _____

Protocol

1. Setup checklist
    a. Put water bottle and pen on table.
    b. Put piles of papers on chair away from table, next to you. Papers to have
        i. On table:
            1. CSE 142 cheat sheet
            2. Pen
            3. Water bottle
            4. Phone (to record audio)
        ii. Aside, next to you:
            1. Warm-up questions (e.g. "Name 10 places people live). 4 sheets of paper
            2. Set of questions
            3. <IF STRATEGY>: face down: strategy sheet, memory table (x3)
            4. Laptop (for post-survey)
        iii. On clipboard:
            1. Protocol
            2. Set of questions
        iv. Watch (to keep time)
    c. Have clipboard with problems to take notes on.
    d. Have phone/recording device ready.
    e. Have laptop closed and aside (for post-survey)
2. Logistics
    a. "Hi <name>, thanks for coming! Here's a water for you. How are you feeling today?"
    b. Were you able to complete the pre-survey?"
        i. If no: "Let's have you take the survey now."
    c. After survey: "It's really hard for me to take notes quickly enough. Do you mind if I record us talking?"
        i. Start recording
    d. "We have an hour and a half for the study and tutoring. Will you be able to stay for the entire time?"
        i. If you have time: "Will you have to leave immediately at <end time>, or can we go a few minutes over?"
    e. "Before we begin, let me ask you a few logistical questions:" <SEE PRE-STUDY QUESTIONS SHEET>

PRE-Study Questions

Did you complete the pre-survey prior to arriving? (If not, have them do it now.)	YES / NO
How many hours of sleep did you get last night?	
How many practice midterm problems have you attempted? (One midterm = 8 problems)	
What is your strategy for solving a problem that asks you to read some code and then predict the output?	

3. Study Intro
    a. "The objective of this study is to understand your thought process as you comprehend what code does"
    b. "This study does not impact your CSE 142 grade and personally identifiable information will never be shared with anyone outside of the research team."
    c. "The study will consist of two parts:"
        i. "The first part will consist of a think-aloud where you will work through problems and verbalize your thinking. Although I will not be able to help you directly here, I will be able to understand your thought process. This will be helpful for the tutoring"
        ii. "The second part is tutoring. Here, you will be able to ask questions relating to the midterm and I will do my best to help you"
    d. "Do you have any questions?"

4. practice think-aloud
    a. "Now I'm going to explain what think-aloud is, and you'll get some practice."
    b. "For the following tasks, I'm interested in what you think about when you find answers to some questions that I am going to ask you to answer. In order to do this, I am going to ask you to THINK ALOUD as you work on the problem given."
    c. "What I mean by think aloud is that I want you "to tell me EVERYTHING you are thinking from the time you first see the question until you give an answer. I would like you to talk aloud CONSTANTLY from the time I present each problem until you have given your final answer to the question."
    d. "I don't want you to try to plan out what you're going to say or try to explain to me what you are saying. Just act as if you are alone in the room speaking to yourself. To help with this, I'll stand behind you after you start doing problems."
    e. It is most important that you keep talking. If you are silent for any long period of time I will ask you to talk by saying "Please Keep Talking". Do you understand what I am asking of you? <WAIT>
    f. Good, now we will begin with some practice problems. First, I want you to answer a question and tell me what you are thinking as you develop an answer. I will NOT be able to answer any of your questions. Just do the best you can. So, answer this and tell me what you are thinking as you get an answer. <GIVE PRACTICE SHEET, stand behind. Note time in margin of this page.>
    <when done step back into view (forward) and talk from the right side>
    g. Good, now I want to see how much you can remember about what you were thinking from the time you read the question until you gave the answer.
        i. I am interested in what you actually can REMEMBER rather than what you THINK - YOU - MUST - HAVE - THOUGHT.
        ii. If possible I would like you to tell me about your memories in the order in which they occurred while you were working on the question. Please tell me if you are uncertain about any of your memories. I don't want you to work on solving the problem again; just report everything that you can remember thinking about when answering the question. Now, tell me what you remember. <PRETEND TO TAKE NOTES>

    h. Good . Now I will give you more practice problems before we proceed. I want you to do the same thing for each of these problems. I want you to think aloud as you think about the question (just like you have been doing). After you have answered it, I will ask you to report all that you can remember about your thinking.
    Any questions? Here is your next problem.
    <TAKE PREVIOUS SHEET. GIVE SHEET, stand behind>
    i. Good, now, tell me what you can remember thinking.
    <listen, describe any differences>
    j. Here is your next problem.
    <GIVE SHEET>
    <Stop after 2 problems if participant understands think aloud. Continue to 3rd if not>
    k. Good. As a reminder, You don't have to talk to me or explain what you are doing to me. Just say out loud the thoughts that come into your mind as if you are alone by yourself."

STRATEGY CONDITION ONLY. SKIP ENTIRE PAGE IF CONTROL

1. "I'm now going to teach you a new strategy for reading code. In this strategy, you will execute code just like a computer. We think this strategy will improve your ability to read code."
2. "While you have your own strategies, we would like you to try this strategy during the study. Do you understand what we are asking of you?"
   <WAIT>
3. "Great. I'm going to give you two sheets of paper. This one describes the 3 step strategy. Let's go through this together." <GIVE STRATEGY PAPER>
    a. "The first step is about figuring out what the question is asking of you. Once you have read and understand the question, put a checkmark by the instruction to show that you have done that."
    b. "The next step is figuring out where the code begins running. Find that line and draw an arrow to the left of it."
    c. "Finally, we are going to execute each line of the code. One line may have multiple parts. You will have to follow the rules of Java that you have been learning in class."
    d. "You may have to update the memory table. Let me show you what memory tables look like:" <GIVE MEMORY TABLES HANDOUT>
4. "The instructions on how to use the memory table are written at the top. This page has 4 memory tables"
    a. "You use a new table for each method that is called. So if the same method is called 3 times, you would need to use 3 different memory tables."
    b. "To use a memory table, begin by writing the method name in the box up top."
    c. "For every parameter that is passed in and every variable that is declared, write the variable name in the 'name' column and the value in the 'value' column."
    d. "Every time a variable is updated, find the variable in the memory table by finding its name in the 'name' column and updating the corresponding 'value'."
    e. "To be clear, the 'name' column will only have variable and parameter names; the value column will only have values such as integers and strings."
    f. "When a method is finished executing, write the return value at the bottom of the table if there is one, and cross out the entire table." <use pen or finger to simulate crossing out a table>
5. "Let's get some practice. I'll help you apply this strategy towards a practice problem. Go ahead and think-aloud in this problem, just like you were doing in the previous problems. I will interrupt you with instructions for this problem only."
    a. "Go ahead and work through step 1." <WAIT. Ensure checkmark made.>
    b. "Great. Now work through step 2." <WAIT. Ensure arrow points to line 1. If not, correct with minimal explanation.>
    c. "Great. Now work through step 3." <WAIT>
    d. <When line 2/main method line happens, ensure memory table created. If not…>
       "So at line 2, the main method starts. So, we will want to create a memory table. Go ahead and do that now."
    e. <Correct them if not using memory table properly by reiterating instructions. Focus on correcting strategy mistakes, not semantic understanding mistakes>
        i. 2: ensure memory table created (main); 3,4,6: ensure rows added; 10: new memory table created (printSum); 14: two rows added; 15: return added then table crossed out

6. Great job. Do you have any questions about this strategy?

"Good, now, let's begin with some programming problems. Again, please think-aloud as if I am not in the room.

<**STRATEGY CONDITION ONLY** (if control, skip this *paragraph*)>: "I have provided you with a few more sheets with memory tables, but eventually you will run out of sheets and have to start drawing your own memory tables."

Go ahead and get started on this problem." <Give sheet>

5. answer questions and think-aloud
   For each sheet:
   a. "Here is your next problem."
      <GIVE SHEET, stand behind>

   b. Remind them "Please keep talking" if they become quiet.
      i. Note where/when they become quiet

   c. If 10 minutes elapses or student shows signs they have given up or are stuck, end the question and move.
      i. Signs of giving up: student has gone quiet, going off on tangent, say they have given up (move on to next step)

   d. "Good, now, tell me what you can remember thinking."
      <listen, describe any differences>

Participant's Name: _____ Study Date: _____ Current Time: _____

6. Interview & follow-up questions
    a. "This concludes the problem solving and think-aloud. Thank you for your participation! Now I'm going to ask you a few follow questions."
    b. <READ QUESTIONS OFF OF POST-STUDY QUESTIONS>

POST-Study Questions

(Researcher: Feel free to ask reasonable follow-up questions. Specifically, ask about any **intermediate steps they wrote on the sheet** (e.g. tables to record variables).

CONTROL ONLY (skip to next page if strategy condition)

Can you describe the strategy you used for solving these problems?

How did you learn these strategies?

Did CSE 142 teach you any specific strategies?

(Write follow-up questions below)

STRATEGY ONLY

Can you describe how the strategy we introduced is **different** from strategies you've used in the past?

What do you think are the **advantages** of this strategy?

What do you think are the **drawbacks** of this strategy?

Do you think you would use this strategy?

(If yes, follow up:) When would you use this strategy?

(If not:) What strategy would you use instead?

Did CSE 142 teach you any specific strategies?

(Write follow-up questions below)

7. Post-survey
    a. "Great. Now I need to scan these pages. While you wait, I'd like you fill out a brief post-survey."
    b. <Use your laptop if participant doesn't have one. Open incognito window and open post-survey> Link: **tiny.cc/cse142post**
    c. "The survey requires you to sign in with your UW email address. Click the blue 'sign-in' button up top to do that. This is an incognito window, so once you have completed the survey, you can close the window and you will have signed out of your email. Does that make sense?"
    d. "Go ahead and get started." <Collect all pages, walk out of room. Close door behind you.>

       <Scan pages and email to bxie@UW.edu. Then separate their problem sheets from yours and have both readily available. Walk back into the room (total time out of room: ~3-5 min).>
    e. <If they are still working, sit so you cannot see laptop screen and pretend to read papers.>
    f. <Once they are done, close laptop and set aside on table. Laptop will be used again for showing midterm.>

Tutoring Tips:

- Go over questions, correcting any misconceptions
    - "We'll start by reviewing the problems you just worked through and then we'll talk about the midterm format"
    - "The problems you just worked through are probably a little harder than what you'd expect to find on the midterm, although all the concepts in these problems are fair game for the midterm."
- Explain overview of midterm format
    - Go over question format and practice midterm **tiny.cc/cse142mid**
    - Note that assertions question is an odd format and they should practice it.
        - "For the assertions questions, it's important to remember 2 things:
            - 1. While loops can run 0, 1, or many times. So at point E the while loop may have run or it may not have. At point B, you may have just entered the while loop or you are started another cycle
            - 2.
    - Note that we did not cover writing problems (6-8) and they will need to practice it on their own
        - "#8 is supposed to be a more challenging programming problem. It will likely involve using some of the methods from your cheat sheet. Let's review that now."
- Guide them in practicing using the cheat sheet
    - "How to get a random number between 0 and 5 (inclusive)? Between 1 and 6 (inclusive)?"
    - "How do you replace a single letter in a string when you don't know where the letter is?"
        - E.g. change "funny" to "fuxny"