You have been invited to take part in a research study that explores how programmers read and understand code. This study will be conducted by Justin Cappos of the Department of Computer Science and Engineering at New York University. If you agree to be in this study, you will be asked to do the following:

- Read 8 program snippets (each of about 5 lines) and write down the program output while verbalizing your thought process.

- Complete a demographic survey about your programming experience.

Making mistakes as you go is expected, in fact they may help us understand better how you think about code. Your performance during this study will not be shared with your professors, fellow students, or the public, and will not affect your grades.

There are no known risks associated with your participation in this research beyond those of everyday life. By helping the investigator complete this research, you are assisting in the development of better interaction between programmers and code that could have positive benefits for all software developers. Participation in this study will take approximately an hour.

Confidentiality of your research records will be strictly maintained by assigning a pseudonym to each participant. No data is directly linked to any individual participant. Only the researchers who are approved by the IRB office for this study will have access to the participants' identifying information.

To improve the ability to analyze our interaction, we will audio record this session. We will use an automated cloud-based service to transcribe our conversation, but no humans will be involved with that process. Your results will remain anonymous, though parts of your interview may be included in our eventual report of this work.

Participation in this study is voluntary. You may refuse to participate or withdraw at anytime without penalty. For interviews, questionnaires, or surveys, you have the right to skip any questions you prefer not to answer. Nonparticipation or withdrawal will not affect the services you receive at NYU, and if you are a student, will not affect your grades or academic standing.

If you have any questions about the study or your participation in it, or you wish to report a research-related problem, you may contact Justin Cappos at (718) 260-3116, or jcappos@nyu.edu, 2 MetroTech Center.

For questions about your rights as a research participant, you may contact the University Committee on Activities Involving Human Subjects, New York University, 665 Broadway, Suite 804, New York, New York, 10012, at ask.humansubjects@nyu.edu or (212) 998-4808.

Agreement to Participate

_____

Subject's Signature & Date

Study on Code Comprehension

DIRECTIONS:

Thank you for agreeing to participate in this study. Please read these instructions carefully.

We will show you 8 small C programs, and ask you to **hand evaluate each program**, executing the program as if you were a computer. While evaluating each program please **speak aloud your reasoning, thoughts, and actions**. When you have finished answering each of the questions, we will go back and discuss your answers. Please write short notes as you evaluate the programs so we can go back and discuss them afterwards.

For each question please write:

- The output generated by the code

- How confident you are that your answer is correct

Following each code sample, you will find a page divided into two columns. The left hand side is to be used as "scratch paper," for notes or for working through the code (however, you can also write notes anywhere on the page if need be). In the right hand column, labeled "Program Output," please record the output of the program, emitted by the `printf` function. Each program compiles and runs without error. If you are not sure what the correct output is, you please make a verbal and written note of this, and continue as well as you can.

After the test, you will find a questionnaire about you and your programming experience. Please complete this as well.

_____

Example of a Completed Response

Start Time: 9:32 a.m.

Program Code

```
void main() {
  int V1 = 3;

  V1 *= 2;

  printf("%d\n", V1);
}
```

Program Output

6

Finish Time: 9:49 a.m.

_____

2

Program Code Sample 1

```c
void main() {
  int V1 = 0;

  if (10 % 3) {
    V1 = 4;
  } else {
    V1 = 8;
  }

  printf("%d\n", V1);
}
```

Program 1 Notes

Program 1 Output

Start Time: _____

_____

_____

_____

_____

End Time: _____

How confident are you that you evaluated the code correctly?

(Unsure) 1 2 3 4 5 6 (Positive)

Program Code Sample 11

```
void main() {
  int V1 = 0;

  if (0 && 1 || 2) {
    V1 = 6;
  } else {
    V1 = 3;
  }

  printf("%d\n", V1);
}
```

Program 11 Notes

Program 11 Output

Start Time: _____

_____

_____

_____

_____

End Time: _____

How confident are you that you evaluated the code correctly?

(Unsure) 1 2 3 4 5 6 (Positive)

Program Code Sample 13

```c
void main() {
  int V1 = 2;
  int V2 = 3 + V1++;

  printf("%d %d\n", V1, V2);
}
```

Program 13 Notes

Program 13 Output

Start Time: _____

_____

_____

_____

_____

End Time: _____

How confident are you that you evaluated the code correctly?

(Unsure) 1 2 3 4 5 6 (Positive)

Program Code Sample 14

```c
void main() {
   int V1 = 3;
   int V2 = V1 + 4;

   V1++;

   printf("%d %d\n", V1, V2);
}
```

Program 14 Notes

Program 14 Output

Start Time: _____

_____

_____

_____

_____

End Time: _____

How confident are you that you evaluated the code correctly?

(Unsure) 1 2 3 4 5 6 (Positive)

Program Code Sample 19

```
void main() {
    int V1 = 2;
    int V2 = ++V1 - 2;

    printf("%d %d\n", V1, V2);
}
```

Program 19 Notes

Program 19 Output

Start Time: _____

_____

_____

_____

_____

End Time: _____

How confident are you that you evaluated the code correctly?

(Unsure) 1 2 3 4 5 6 (Positive)

Program Code Sample 25

```
void main() {
  int V1 = 3;
  int V2 = V1 + 2;

  printf("%d\n", V2);
}
```

Program 25 Notes

Program 25 Output

Start Time: _____

_____

_____

_____

_____

End Time: _____

How confident are you that you evaluated the code correctly?

(Unsure) 1 2 3 4 5 6 (Positive)

8

Program Code Sample 26

```
void main() {
  int V1 = 2 + 3;

  printf("%d\n", V1);
}
```

Program 26 Notes

Program 26 Output

Start Time: _____

_____

_____

_____

_____

End Time: _____

**How confident are you that you evaluated
the code correctly?**

(Unsure) 1 2 3 4 5 6 (Positive)

Program Code Sample 37

```
#define M1 3 - 1
void main() {
  int V1;

  V1 = M1 * 2;

  printf("%d\n", V1);
}
```

Program 37 Notes

Program 37 Output

Start Time: _____

_____

_____

_____

_____

End Time: _____

How confident are you that you evaluated the code correctly?

(Unsure) 1 2 3 4 5 6 (Positive)

DEMOGRAPHIC SURVEY:

1. What is your age? _____

2. What gender do you identify with? _____

3. What race do you identify with? _____

   Please describe your university education:

Institution	Country	Degree Type (BS/PhD/...)	Course of Study (CS/Math/...)	# of Years (So far)

4. What is your current employment role (student/programmer/manager)? _____

5. During university, how many courses did you take in which you had to program? _____

6. How did you learn to program? _____

7. What is your preferred programming language? _____

8. If you are currently programming on a daily basis, which language(s) do you use? _____

9. Think about the largest C/C++ program that you have either written or contributed to:

   - Roughly how many lines of code was the entire code base? _____

   - Roughly how many lines of code did you contribute? _____

10. How would you estimate your programming proficiency? (please circle an appropriate number)

    - General programming (Novice) 1 2 3 4 5 6 (Expert)

    - C/C++ (Novice) 1 2 3 4 5 6 (Expert)

    - Relative to 2nd year programming students (Worse) 1 2 3 4 5 6 (Better)

    - Relative to professional programmers (Worse) 1 2 3 4 5 6 (Better)

11. Have you ever been a professional programmer? _____

    - If so, for how long? _____

12. Have you ever been a professional programmer using primarily C/C++? _____

    - If so, for how long? _____

Please list each programming language you've used, along with the year in which you learned it, the number of years you've spent actively working with the language, and an estimate of the total number of lines of code you've written for each. For example if you learned C in 2012 and used it for the next year, but didn't use it again until you starting programming in C last year, your entry may look like this:

Language	Learned Year	Active # Years	Lines	Notes
C	2012	2	30k	Read K&R book

Please fill out the table below:

Language	Learned Year	Active # Years	Lines	Notes

Please use the space below to share with us anything about your programming knowledge and experience not captured by the previous questions.