Module 1: Variables

Learning Objectives

1. Distinguish variables, memory addresses, and values.

Process Skills

1. Teamwork. Perform assigned roles while working towards completing the activity.
2. Information processing. Identify key information and make generalizations from examples.

Please fill in the roles for each member of your team. Take a look at the description of each role to see its responsibilities. If there are only three people in the group, please assign the same person to the **Presenter** and **Reflector** role. It is a good idea to select roles that you have not recently taken.

Team name: _____ Date: _____

Role	Team Member Name
Manager. Keeps track of time and makes sure everyone contributes appropriately.	
Presenter. Talks to the facilitator and other teams.	
Reflector. Considers how the team could work and learn more effectively.	
Recorder. Records all answers and questions and makes the necessary submission.	

For virtual activities: Once you select your roles, change your Zoom name using the format and example below.

Format: *Group X: First name, Last name initial / Role*

Example: *Group 1: Paul I / Presenter*

Model 1. Variables and memory (10 min) Start time: _____

```
int main() {
 int working_hours = 8;
 bool is_open = true;
}
```

Symbol Table

Variable Name	Scope	Type	Memory address*
is_open	main()	bool	0x7ffd24530e43
working_hours	main()	int	0x7ffd24530e44

Note: sequence is not important for this activity
** memory addresses are often represented in [hexadecimal format (https://en.wikipedia.org/wiki/Hexadecimal)](https://en.wikipedia.org/wiki/Hexadecimal)*

Memory Visualization

	Value
0x7ffd24530e43	true
0x7ffd24530e44	
0x7ffd24530e45	
0x7ffd24530e46	
0x7ffd24530e47	8
0x7ffd24530e48	
0x7ffd24530e49	
0x7ffd24530e4A	

1. C++ uses *symbol tables* to store a program's information about variables and other data. According to the *symbol table*, which memory address does the `is_open` variable reference?

0x7ffd24530e43

2. The memory visualization table shows how data may be stored in your computer's memory. Which memory addresses stores the value assigned to the `working_hours` variable? In our visualization, one row stores 1 byte. Most C++ implementations use 4 bytes to store booleans and 4 bytes to store integers.

0x7ffd24530e47
0x7ffd24530e48
0x7ffd24530e49
0x7ffd24530e4A

3. How does the compiler store the value `8` when it performs the statement:

```
int working_hours = 8;
```

Place a check (✅) beside your answer.

a. It stores 8 in the memory address that `working_hours` references. ✅
b. It stores 8 in the symbol table row corresponding to `working_hours`.
c. It stores 8 in any available memory address.
d. It always stores 8 in memory address 0x7ffd24530e47.

4. Illustrate how the variable declared below will be represented in memory.

```
int main() {
 int age = 20;
}
```

Symbol Table

Variable Name	Scope	Type	Memory address
age	main()	int	0x7fffa0d698ec

Memory Visualization

	Value
0x7fffa0d698ec	20
0x7fffa0d698ed	
0x7fffa0d698ee	
0x7fffa0d698ef	
0x7fffa0d698f0	
0x7fffa0d698f1	

Reflector questions

1. What was the most useful thing your team learned during this session?

2. What were the challenges your team faced in performing your assigned roles?

3. What factors made it easy/hard for you to make generalizations from the examples (e.g., concept, illustrations, instructions)?