

# Constexpr If Solutions

# Constexpr If

- Briefly describe constexpr if
  - constexpr if evaluates conditionals at compile time
  - It also conditionally compiles code - only the code in the "true" branch is compiled into the program

# Runtime If Statement

- Explain why the following code does not compile

```
template<typename T>
string get_string(const T& arg) {
    if (std::is_same<std::string, T>::value)      // Replaced by "true" if T is a string, else "false"
        return arg;
    else
        return std::to_string(arg);
}
```

# Runtime If Statement

- Explain why the following code does not compile
  - This code uses an if statement which will be evaluated at runtime
  - When the compiler checks the instantiated template, it must assume that either branch can be taken
  - Both branches must compile
  - If T is not a string, the first branch does not compile
  - If T is a string, the second branch does not compile

# Constexpr If Statement

- Explain how `constexpr if` can solve this problem
  - With `constexpr if`, the statement will be evaluated at compile time
  - Only one of the branches will be present in the program's source code after the template is instantiated
  - When the compiler checks the instantiated template, it will only see the branch which is taken, which will always compile
- Write a simple program to check your solution

# Advantages of Constexpr If

- List some alternatives to using `constexpr if` and explain the advantages of using `constexpr if`
  - Preprocessor directives such as `#if` perform textual substitution
    - No understanding of C++ syntax or types
  - Template Specialization
    - Requires multiple functions which need to be in a specific order
    - Not suitable for complex tests
  - SFINAE and `enable_if`
    - Complex and obscure code
    - Incomprehensible error messages
  - `constexpr if`
    - Single function with normal-looking code
    - Normal-looking error messages