Computer Programming

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Session: Conditional Execution in C++ Programs - Part B

Quick Recap of Some Relevant Topics

- Structure of a simple C++ program
- Variables and type declarations
- Assignment statements
- Arithmetic and logical expressions
- Sequential execution of statements
- Conditional execution using “if … else …” statement

Overview of This Lecture

- Conditional execution of statements in C++

  "switch … case …" statement

- Conditional expressions in C++

Recalling Some Useful Facts

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- Program: sequence of compiler directives, declarations, instructions
- Normally, computer executes instructions
  - In same order in which they appear in program
- "if … else …" statement allows computer to execute instructions in non-linear order

A Programming Problem

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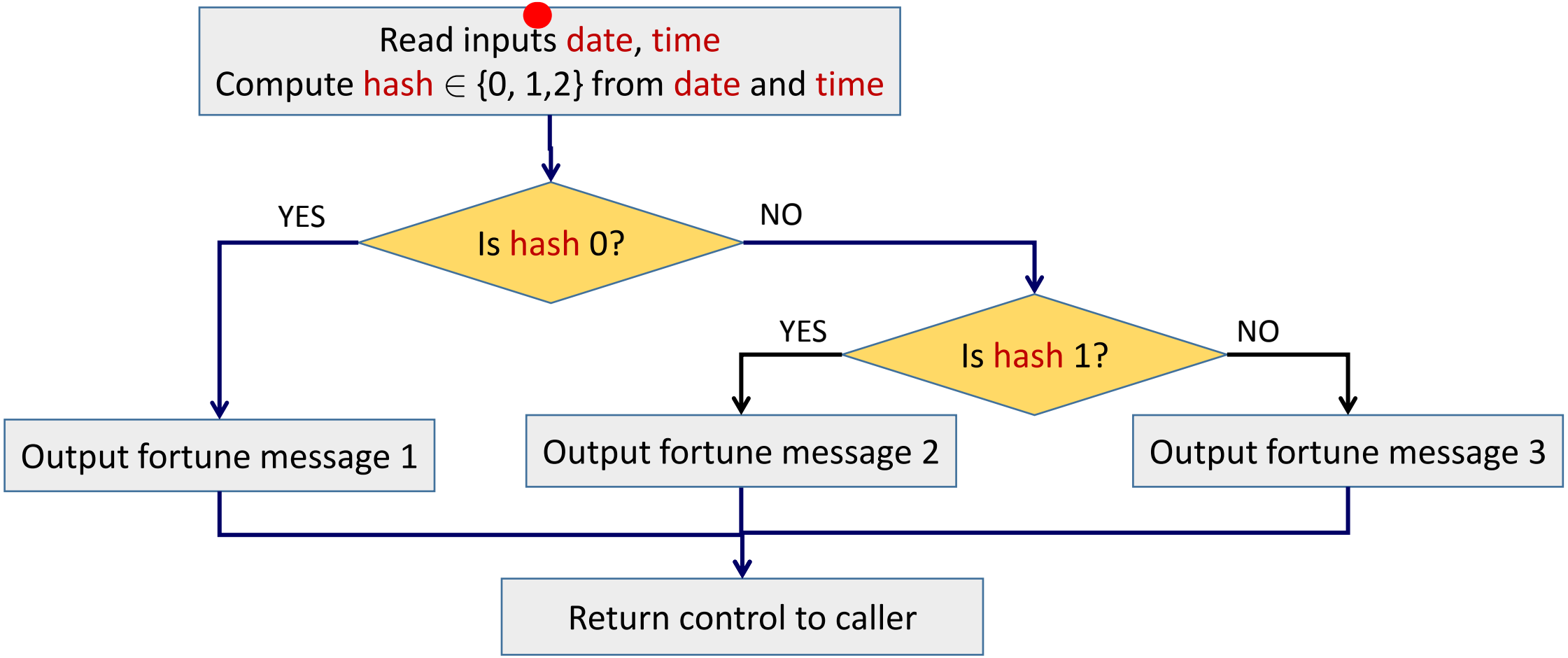
We want to implement a simple "fortune" program

- Read date and time as integers
- Output one of three pre-determined "fortune" messages depending on date and time

Flowchart for Simple “fortune” Program



An Example "fortune" Program

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```
// A simple "fortune" program
int main() {
  int date, time, hash;  // Variable declarations
  cout << "Give date (DDMMYYYY) and time (HHMM)" << endl;
  cin >> date >>  time;
  hash = (date + time) % 3;  // Compute a hash value in {0, 1, 2}
  if (hash == 0) { cout << "Time and tide wait for none."  << endl; }
  else {
    if (hash == 1) { cout << "The pen is mightier than the sword." << endl; }
    else { cout << "Where there is a will, there is a way." << endl; }
  }
  return 0;
}
```

Nested if … else … statements

An Example “fortune” Program

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```
// A simple “fortune” program
int main() {
  int date, time, hash;  // Variable declarations
  cout << “Give date (DDMMYYYY) and time (HHMM)” << endl;
  cin >> date >>  time;
  hash = (date + time) % 3;  // Compute a hash value in {0, 1, 2}
  if (hash == 0) { cout << “Time and tide wait for none.“  << endl; }
  else {
    if (hash == 1) { cout << “The pen is mightier than the sword.” << endl; }
    else { cout << “Where there is a will, there is a way.” << endl; }
  }
  return 0;
}
```

What if we had 10 “fortune” messages?

“switch … case …” Statement in C++

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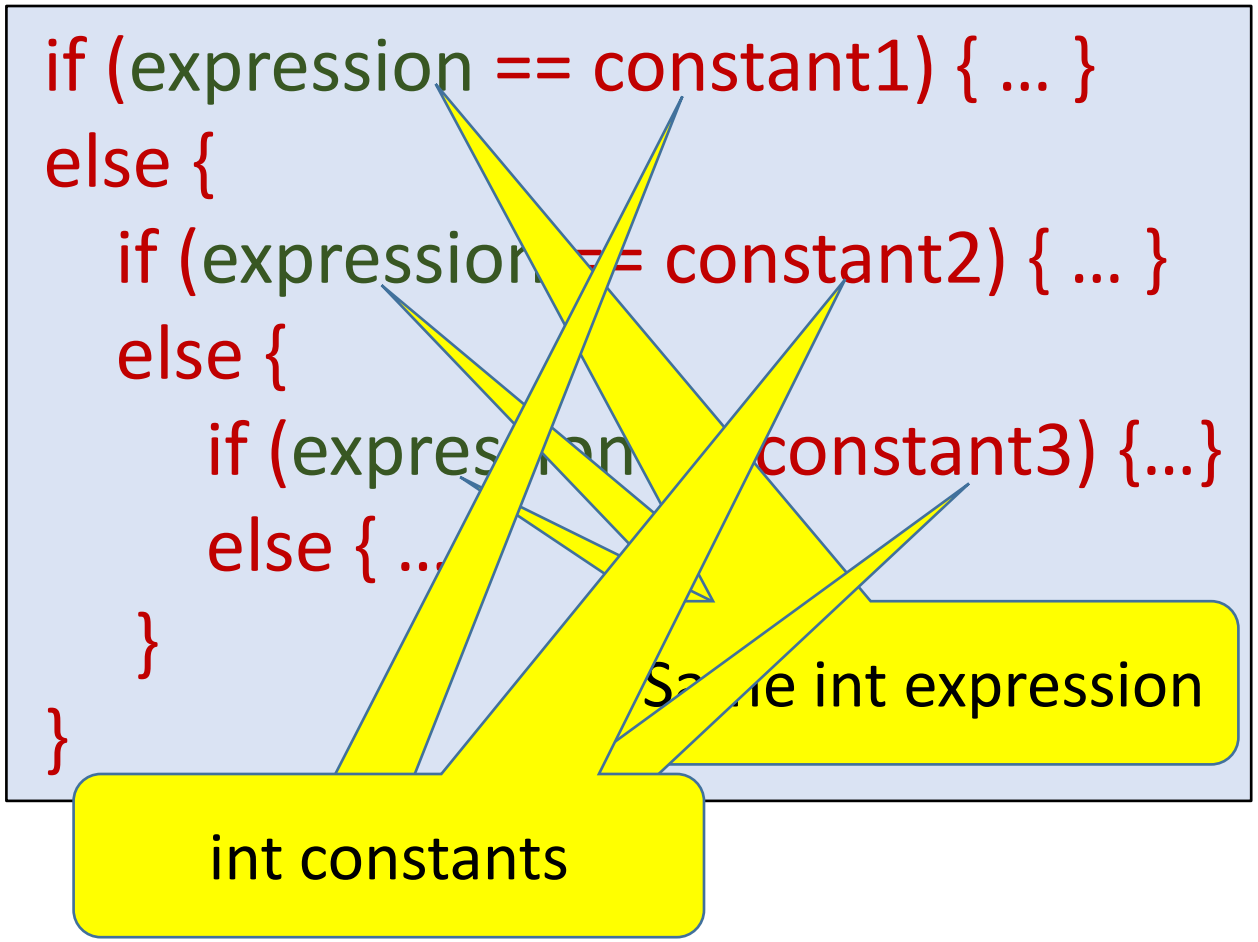
- Alternative to (deeply) nested “if … else …”
- Applicable only when all conditions check equality of same integer expression with different constants



"switch … case …" Statement in C++

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```
if (hash == 0) { cout << "Time and tide wait for none."  << endl; }
else {
 if (hash == 1) { cout << "The pen is mightier than the sword." << endl; }
 else { cout << "Where there is a will, there is a way." << endl; }
}
```

```
switch (hash) {
   case 0:  cout << "Time and tide wa
            break;
   case 1:  cout << "The pen is mighti
            break;
   default:  cout << "Where there is a will, there is a way." << endl;
}
```

switch, case, break, default
C++ keywords

"break" and Fall-Through

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Suppose we did not put **any** "break" statements

Value of hash: 0

```
switch (hash)  {
  case 0:  cout << "Time and tide wait for none." << endl;

  case 1:  cout << "The pen is mightier than the sword." << endl;

  default:  cout << "Where there is a will, there is a way." << endl;
}
return 0;
```





Fall-through of control

"break" and Fall-Through

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Suppose we did not put **some** "break" statements

Value of hash: 0

```
switch (hash)  {
  case 0:  cout << "Time and tide wait for none." << endl;

  case 1:  cout << "The pen is mightier than the sword." << endl;
           break;
  default:  cout << "Where there is a will, there is a way." << endl;
}
return 0;
```





"break" and Fall-Through

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Suppose we did not put some "break" statements

Value of hash: 1

```
switch (hash)  {
  case 0:  cout << "Time and tide wait for none." << endl;

  case 1:  cout << "The pen is mightier than the sword." << endl;
           break;
  default:  cout << "Where there is a will, there is a way." << endl;
}
return 0;
```




Intentional Fall-Through

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- Want all “fortune” messages to be printed if hash is 0, two of them to be printed if hash is 1, and only one otherwise.

```
switch (hash)  {
  case 0:  cout << “Time and tide wait for none.” << endl;

  case 1:  cout << “The pen is mightier than the sword.” << endl;

  default:  cout << “Where there is a will, there is a way.” << endl;
}
return 0;
```

"default" in "switch … case …" Statement

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Similar to final "else" branch in nested "if … else …" statements

If hash doesn't match any "case" values, "default" statements executed

What if hash is 2?

```
switch (hash)  {
  case 0:  cout << "Time and tide wait for none." << endl;
           break;
  case 1:  cout << "The pen is mightier than the sword." << endl;
           break;
  default:  cout << "Where there is a will, there is a way." << endl;
}
return 0;
```

Conditional Expressions

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- Standard arithmetic expressions
  - (a + b) * c, (a + b) / c, …
- What if I want the same expression to take the value of (a+b)*c if (c <= 0) and (a+b)/c otherwise ?

- Easy solution:

```
if (c <= 0)  { expr = (a + b) * c; }
 else {expr = (a + b) / c;}
```

- Alternative solution: expr = (c <= 0) ? (a + b)*c : (a + b)/c;

Conditional Expressions

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- General form

  (logical expression) ? (if-expression) : (else-expression)
- if-expression and else-expression must be of same type
- Type of conditional expression is type of if-expression (or else-expression)
- Can be used for both arithmetic and logical expressions
  - if-expression and else-expression can be both arithmetic expressions
  - if-expression and else-expression can be both logical expressions

Summary

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- Conditional execution of statements in C++ programs
  - "switch … case …" statement and its usage
  - "break" and fall-through
  - "default"
- Conditional expressions