Computer Programming

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Session: Recap of Sequential and Conditional Execution with additional exercises

Quick Recap 1

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- Conditional execution of statements in C++ programs
  - "if … else …" statement and its usage
- An example program with conditional execution
- Arbitrary nesting of "if … else … " statements allowed in C++

A Program With Conditional Execution

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Program to Divide integer A by integer B and output the quotient Q.

```
#include <iostream>
using namespace std;
// Program to compute quotient
int main() {
  int A, B, Q;  // Variable declarations
  cout << "Give A and B" << endl;
  cin >> A >>  B;
  if (B == 0) { cout << "Bad inputs!!!" << endl; return -1;}
  else { Q = A/B; cout << "Quotient is: " << Q << endl; }
  cout << "Be happy!" << endl;
  return 0;
}
```

Flowchart Representation

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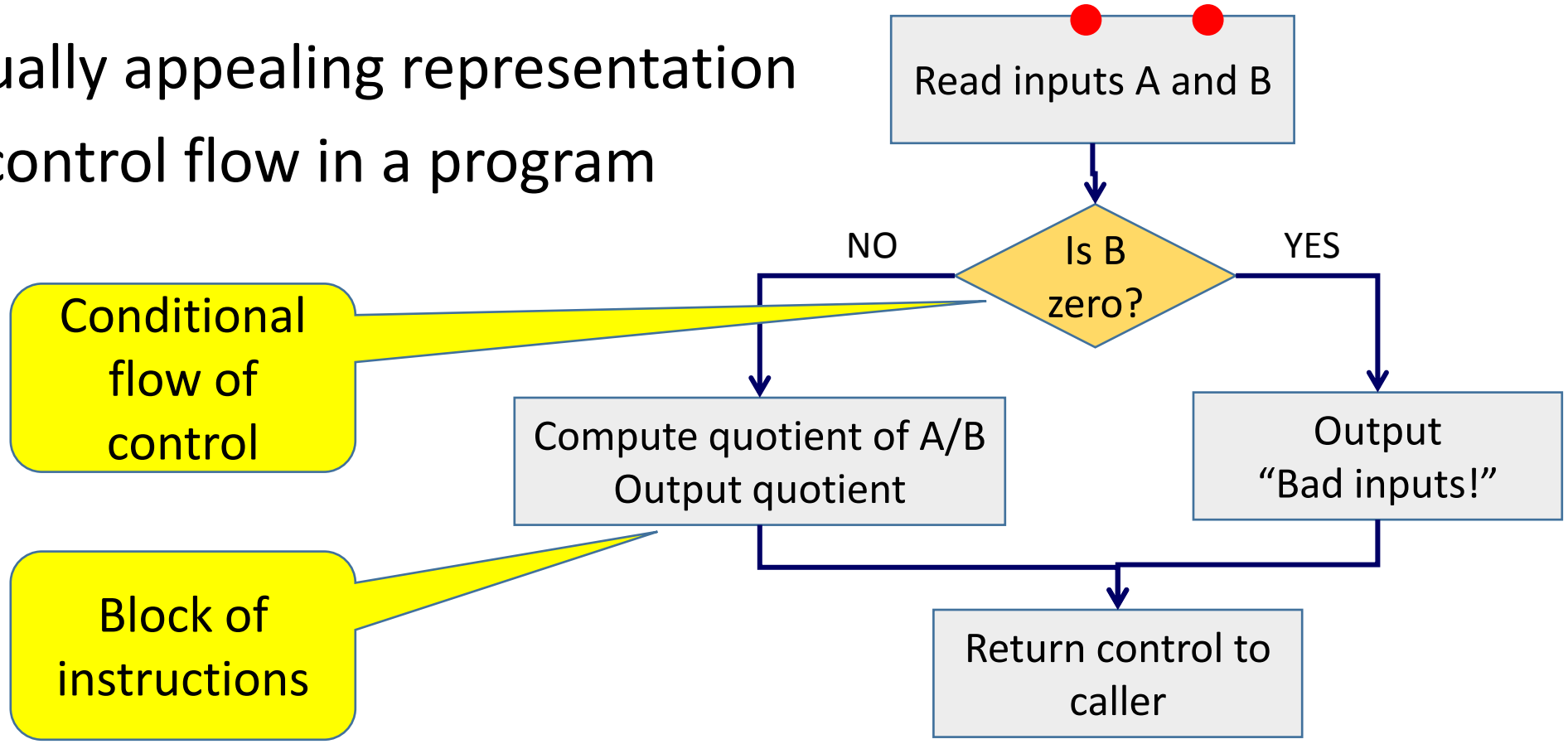
- Visually appealing representation of control flow in a program



Quick Recap 2

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

A Programming Problem

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

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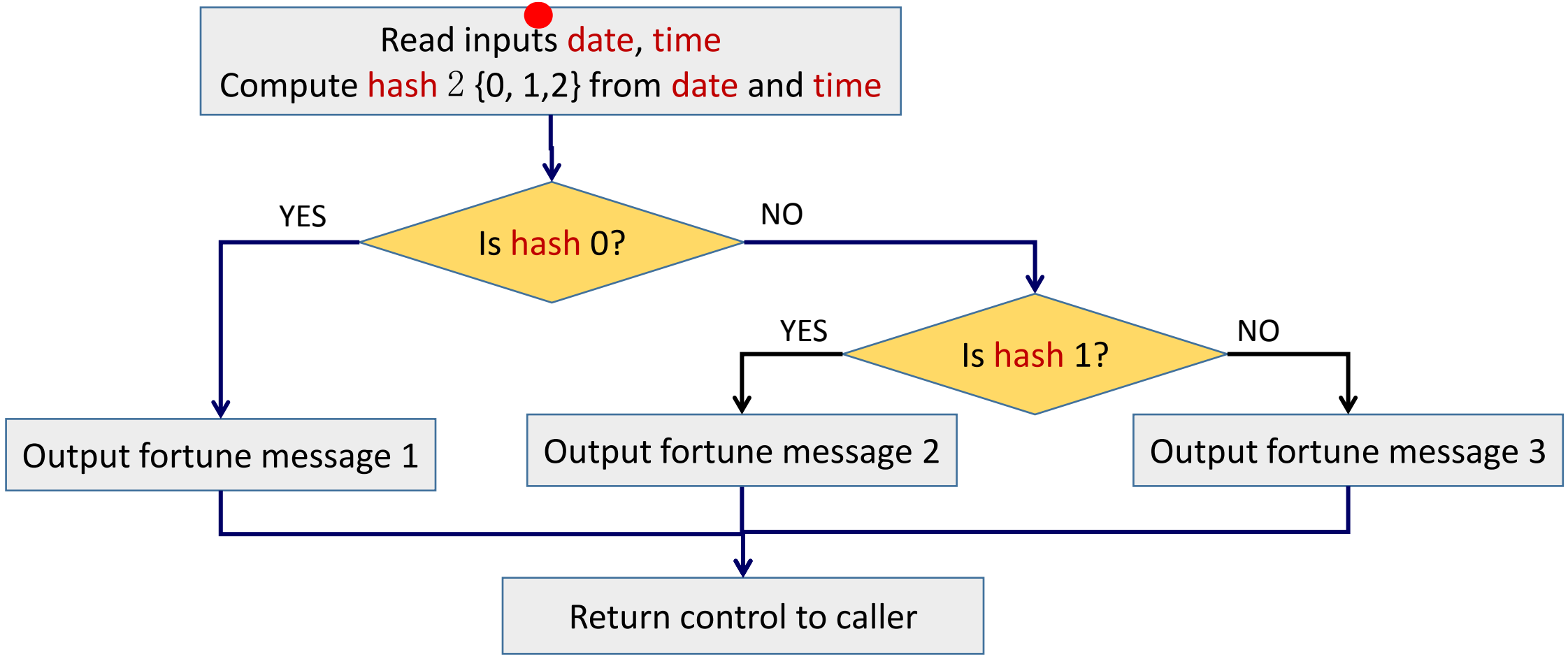

An Example "fortune" Program

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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

What if we had 10 "fortune" messages?

"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;
```

Fall-Through if "break;" is removed

Conditional Expressions

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- General form

  (logical expression) ? (if-expression) : (else-expression)

  Example: expr = (c <= 0) ? (a + b)*c : (a + b)/c;

- 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

Quick Recap 3

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- A simple, yet interesting program that uses
  - Integer variables
  - Assignment statement with arithmetic expressions
  - Logical expressions
  - Sequential execution
  - Conditional execution using "if … else …" statements
    Nested "if … else … " statements
  - Condition execution using "switch … case …" statements
  - "cin" and "cout"

An intelligent “fortune” program

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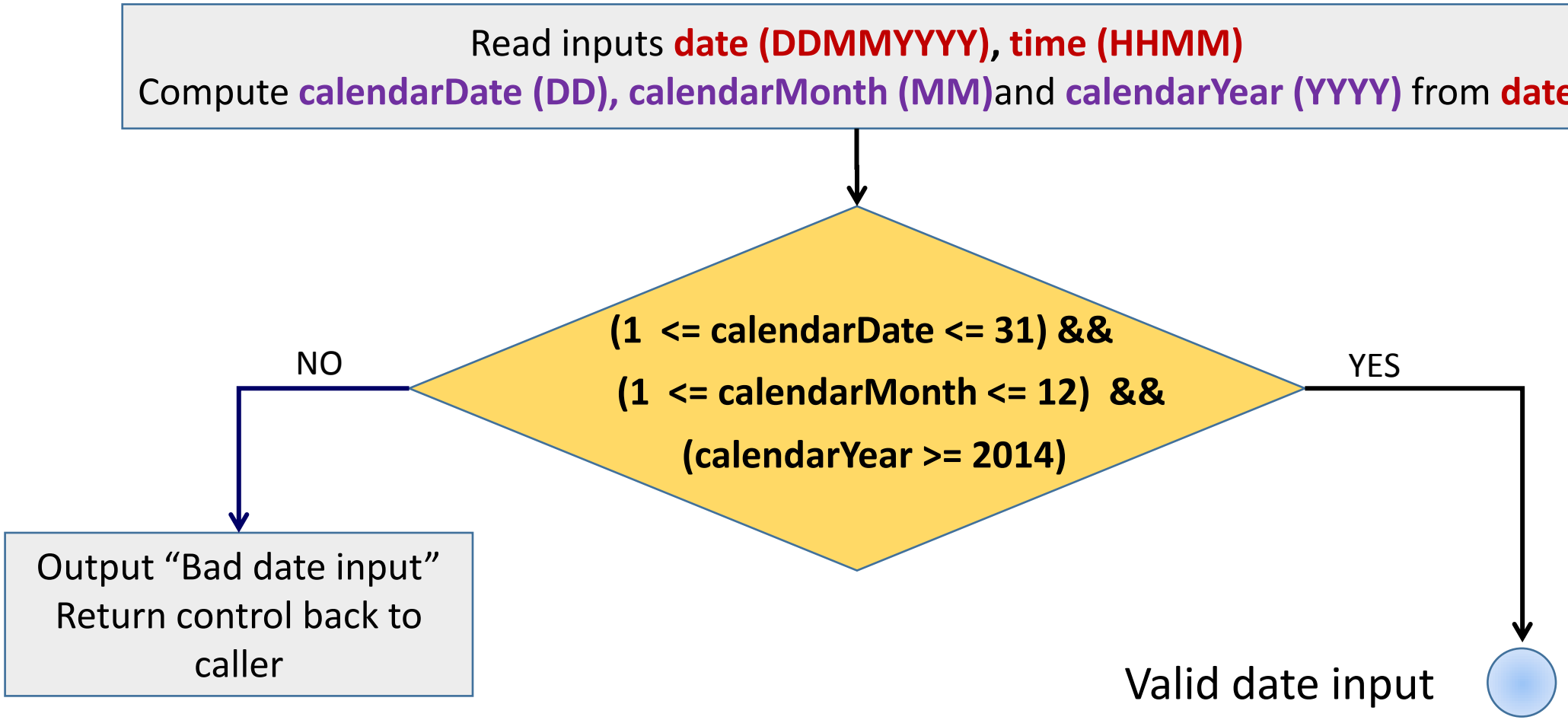
Given date (DDMMYYYY) and time (HHMM) as integers,

Check for invalid date and time

If inputs are valid, output “Good morning”, “Good afternoon”, or “Good evening” depending on time of day

Output one of three pre-determined “fortune” messages

Flowchart for Checking Validity of Date



Flowchart for Checking Validity of Time

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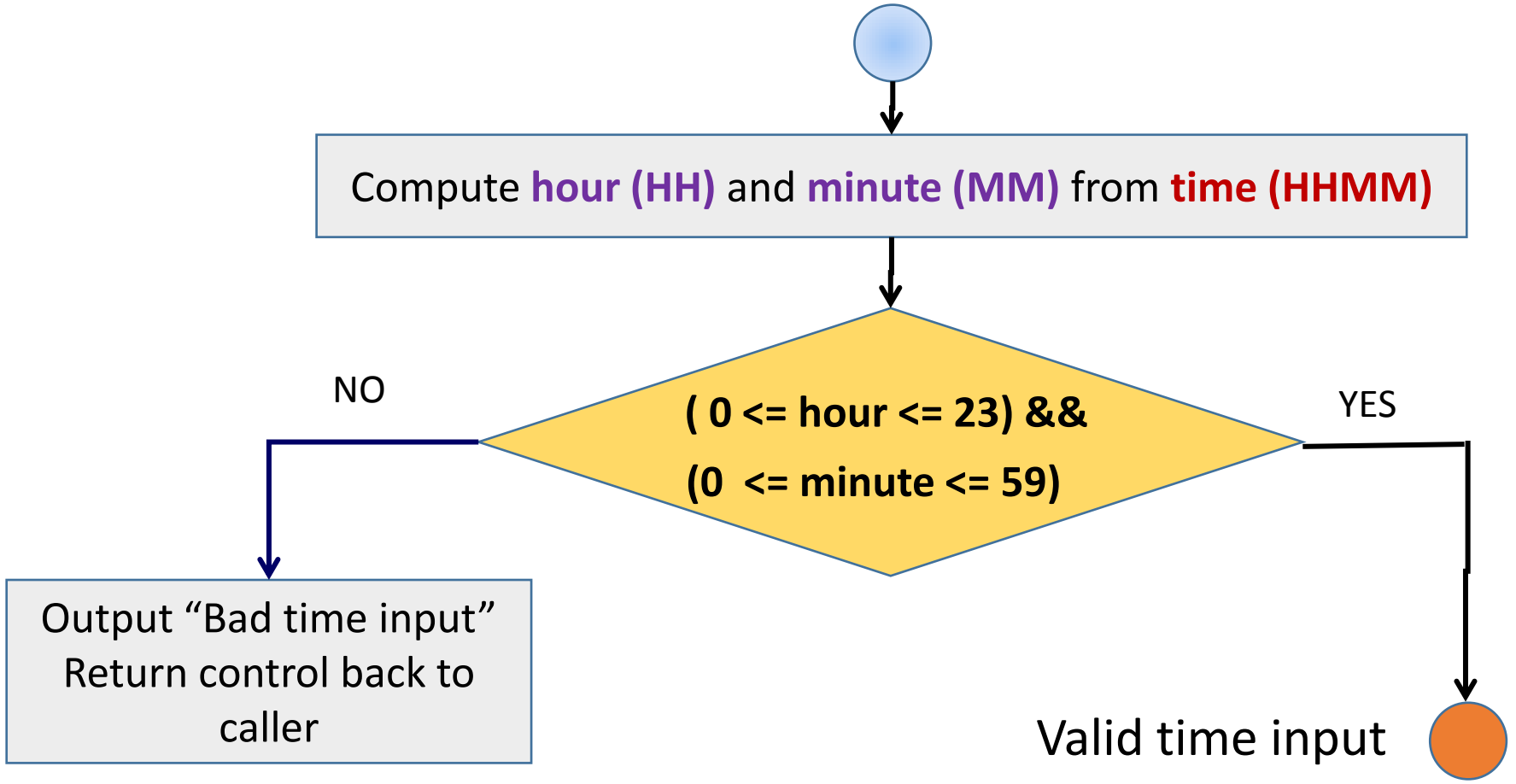

Quiz Questions

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Q1. What are the possible expression(s) you could enter as the condition of an *if statement*:

A. if(flag) ,where flag is bool type
B. if(‘a’ > ’’b’’)
C. if(5>6 || 3<4)
D. if(‘c’ == ‘C’)
E. None of these

Quiz …

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Q2. A *fall-through* is:

A. Missing an ‘else’ in a nested if-else
B. Forgetting ‘break’ in your switch case menu
C. Not providing a ‘default’ case to a switch menu
D. None of these

Quiz …

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Q3. Identify all the incorrect statement(s) from the following:

A. A switch menu must have at least 3 cases
B. A fall-through is never useful
C. If-else is preferred over switch for multiple conditions
D. Switch case can only use integer control variables

Quiz …

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Q4. Evaluate the output, if marks=55:

```
Grade = (marks>80) ? (‘A’) : (marks>40) ? (‘D’) : (’F’);
cout<<Grade;
```

A. A

B. D

C. F

D. Error in code

Quiz …

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Q5. Fill in the blanks, to complete a code snippet to extract date from an integer input date (DDMMYYYY):

- calendarYear = date % _____;
- calendarDateAndMonth = date __ 10000;
- calendarMonth = calendarDateAndMonth __ 100;
- calendarDate = calendarDateAndMonth / ___;

Exercises for In-Class Discussions

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Exercise 1: Write a program to print whether the number entered is even or odd

contd …

Exercises for In-Class Discussions

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Exercise 2: Find the largest/smallest of three numbers and output the largest/smallest

contd …

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Exercise 3: Write a program to input 5 numbers, and output the second largest number.

contd ...

Exercises for In-Class Discussions

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Exercise 4: Write a program to input a 3-digit number, and display the sum of all its digits.

contd ...

Exercises for In-Class Discussions

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Exercise 5: Given any year as a 4 digit integer number, we wish to find out the day on 31st December of that year (e.g., Sunday, Monday, Tuesday, etc.).

contd …

Exercises for In-Class Discussions

Exercise 6: Write a C++ program which decides the Grades of the employees of the XYZ company based on the performance index PI he has earned while working in the company. 'PI' lies between 0 and 1(Inclusive).

Input: Value of PI between 0 and 1. Display error 'Invalid Performance Index' if user enters the value of PI value not between 0 and 1.

Output: The grade of an employee as per the following rules:

contd …

Exercises for In-Class Discussions

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Sr. No.	PI	Grade
1	0.9 <= PI <= 1	A+
2	0.75 <= PI<= 0.9	A
3	0.6 <= PI <= 0.75	B
4	0.45 <= PI<= 0.6	C
5	0 <= PI <= 0.45	D

contd ...

Exercises for In-Class Discussions

Exercise 7: Given as input the lengths of three sides of the triangle, write a C++ program to decide whether it is an isosceles, equilateral or a scalene triangle.

Modify the program to make sure it also prints whether the triangle is a right angled triangle or not.

contd …

Exercises for In-Class Discussions

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Exercise 8: Write a program to input 2 integer values m and n, where m > n, and output the corresponding Pythagorean triple $m^2 - n^2$, 2mn, and $m^2 + n^2$. Ensure that m is greater than n.

contd ...

Exercises for In-Class Discussions

Exercise 9: Using already studied if else and switch block, write a program to make a simple calculator for adding, subtracting, multiplying, and dividing two numbers.

contd …

Exercises for In-Class Discussions

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Solution to Exercise 3 only

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```
int main(){
int year,day;
cout<<"give me the year"<<endl;
cin>>year;
day = ((year)*365+(year)/4-
   (year)/100+(year)/400)% 7;
if(day==0) cout<<"31st Dec
   "<<year<<" is "<<"Sunday";
if(day==1) cout<<"31st Dec
   "<<year<<" is "<<"Monday";
if(day==2) cout<<"31st Dec
   "<<year<<" is "<<"Tuesday";
if(day==3) cout<<"31st Dec“
   <<year<<" is “ <<"Wednesday";
if(day==4) cout<<"31st Dec
   "<<year<<" is "<<"Thursday";
if(day==5) cout<<"31st Dec
   "<<year<<" is "<<"Friday";
if(day==6) cout<<"31st Dec
   "<<year<<" is "<<"Saturday";
return 0;
}
```