ĐẠI HỌC BÁCH KHOA HÀ NỘI
VIỆN CÔNG NGHỆ THÔNG TIN VÀ TRUYỀN THÔNG

Week 6:
Branch Statements

Topic of this week

- Branches
  - If selection structure
  - Switch selection structure
- Programming Exercises

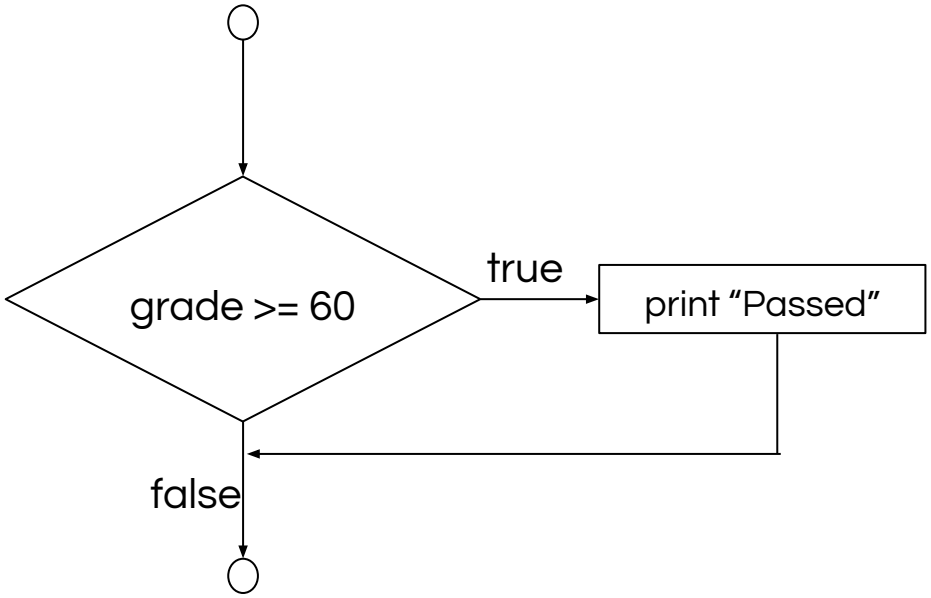
The `if` Structure

- Used to perform specific actions when a given condition is true
- Example: *If student's grade is greater than or equal to 60*
  Print "Passed"
- If condition **true**: *Print* statement executed
- If **false** *Print* statement is ignored
- Indenting makes programs easier to read
  - C ignores whitespace characters
- Pseudocode statement in C:

```
if (grade >= 60)
printf( "Passed\n" );
```

The `if` Structure

- Diamond symbol indicates condition
- **if** structure is a single-entry/single-exit structure.



A decision can be made on any expression.

zero - **`false`**

nonzero - **`true`**

Example:

`3 - 4` is **`true`**

The `if/else` Structure

- **`if`**: only performs actions if the condition is **`true`**.
- **`if/else`**: performs actions in both cases **`true`** and **`false`**

- Psuedocode:

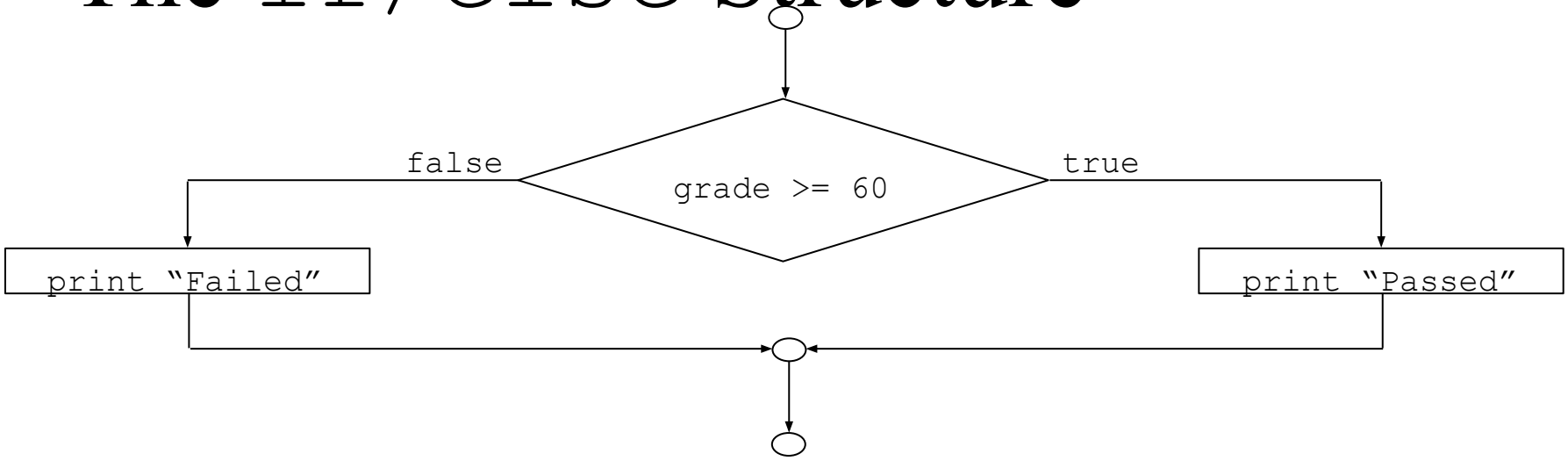
```
if grade is greater than or equal to 60
   Print "Passed"
else
   Print "Failed"
```

  - Note spacing/indentation conventions

- C code:

```
if ( grade >= 60 )
   printf( "Passed\n");
else
   printf( "Failed\n");
```

The `if/else` Structure



Ternary conditional operator (**?:**)

- Takes three arguments (condition, value if **true**, value if **false**)

```
printf( "%s\n", grade >= 60 ? "Passed" : "Failed" );
```

OR

```
grade >= 60 ? printf( "Passed\n" ) : printf( "Failed\n" );
```

The `if/else` Structure

- Nested **`if/else`** structures
  - Test for multiple cases by placing **`if`**/**`else`** selection structures inside **`if`**/**`else`** selection structures

```
if student's grade is greater than or equal to 90
   Print "A"
else
   if student's grade is greater than or equal to 80
         Print "B"
   else
         if student's grade is greater than or equal to 70
               Print "C"
         else
                  if student's grade is greater than or equal to 60
                     Print "D"
               else
                     Print "F"
```

  - Once condition is met, rest of statements skipped
  - Deep indentation usually not used in practice

The `if/else` Structure

- Compound statement:
  - Set of statements within a pair of braces
  - Example:

```
if ( grade >= 60 )
   printf( "Passed.\n" );
else {
   printf( "Failed.\n" );
   printf( "You must take this course again.\n" );
}
```

  - Without the braces,

```
printf( "You must take this course again.\n" );
```

    would be automatically executed

- Block: compound statements with declarations

The `if/else` Structure

- Syntax errors
  - Caught by compiler

- Logic errors:
  - Have their effect at execution time
  - Non-fatal: program runs, but has incorrect output
  - Fatal: program exits prematurely

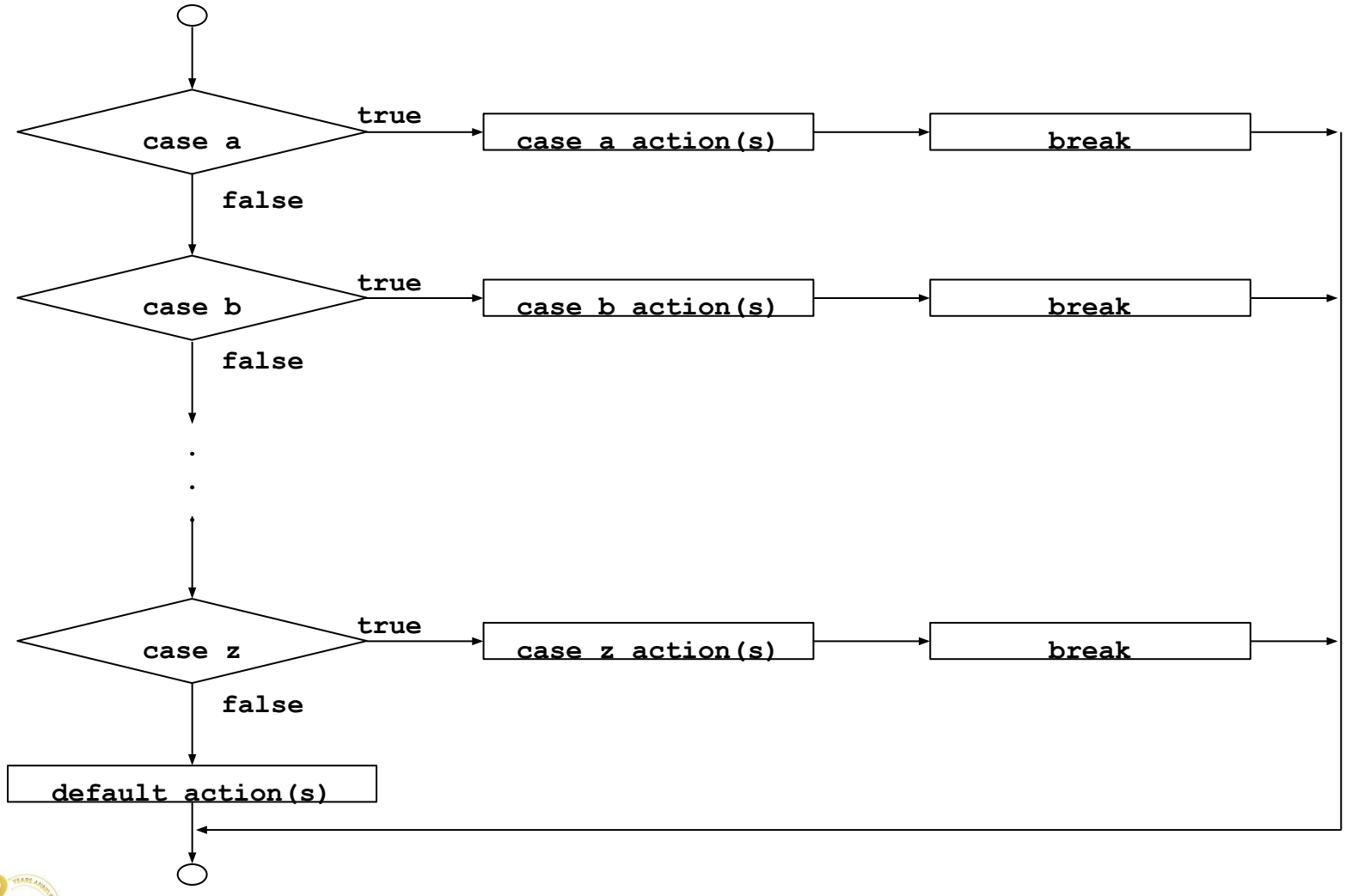
The `switch` Multiple-Selection Structure

- **`switch`**
  - Useful when a variable or expression is tested for all values and different actions are taken.
- Format
  - Series of **`case`** labels and an optional **`default`** case

```
switch ( value ){
    case '1':
        actions
    case '2':
        actions
    default:
        actions
    }
```

  - **`break;`** causes exit from structure

The `switch` Multiple-Selection Structure



The `switch` Multiple-Selection Structure

- Example of Switch

```
c = getchar();
switch (c) {
   case '0': printf("Zero\n"); break;
   case '1': case '2': case '3': case '4':
   case '5': case '6': case '7': case '8':
   case '9': printf("Nine\n"); break;
   case ' ':
   case '\n': newln++; break;
   case '\t': tabs++; break;
   default: printf("missing char\n"); break;
}
```

Exercise 6.1

- Write a program that asks user to enter 03 chars, then finds and displays the char whose smallest ASCII code
- e.g. type IBK => display B

Solution

```
#include <stdio.h>
int main()
{
    char ch1, ch2, ch3;   /* three letters */
    char alpha_first;     /* first letter */

      printf("Enter three letters: ");
    scanf("%c%c%c", &ch1, &ch2, &ch3);
```

Solution

```
    if (ch1 < ch2)
            alpha_first = ch1;
    else
            alpha_first = ch2;

    if (ch3 < alpha_first)
            alpha_first = ch3;

      printf("%c is the smalest letter\n",alpha_first);

    return (0);
}
```

Exercise 6.2

- Write a program that requires you enter an age and shows you what is your class (child, adult, or senior citizen)
  - Child : age <18
  - Adult : 18<=age<65
  - Senior Citizen: age >=65

Solution

```
#include <stdio.h>
int main()
{
   int age;
   printf("\nEnter an age : ");
   scanf("%d",&age);
   /* Figure out which bracket they are in */
```

Solution

```
if(age > 0)
{
   printf("\nIt is classed as : ");
   if(age < 18)
    printf("\nA Child\n");
   else if(age >= 65)
      printf("\nA Senior Citizen\n");
   else
      printf("\nAn Adult\n");
}
else
   printf("That's not a valid age");
return 0;
}
```

Exercise 6.3

- Improve the exercise6.2

- Assume that a valid age should belong to the range of [0, 200]. After users enters their ages, the program should check the validation of these ages

  age <= 0: not a valid age

  age >= 200: not a valid age

Solution

```
#include <stdio.h>

int main()
{
        int age;

        printf("\nEnter an age : ");
        scanf("%d",&age);

        if(age <= 0 || age >= 200)
        {
            printf("That's not a valid age");
        }
```

Solution

```
else
   {
      printf("\nIt is classed as : ");
      if(age > 0 && age < 18)
         printf("A Child\n");
      else if(age > 18 && age < 65)
         printf("An Adult\n");
      else
         printf("A Senior Citizen\n");
   }
   return 0;
}
```

Exercise 6.4

- Write a program to play “High/Low". The program “picks" a number. The human player tries to guess it. The program indicates if the guess is too high, too low, or correct. Then it stops.
- Sample outputs:

Results

```
Guess my number (between 1 and 10): 5
Your guess was too small.
The correct number was 6.
```

- Use rand() function to pick a random number.

How to generate a random number

```
#include <time.h>
#include <stdlib.h>


..
srand(time(NULL));
rand() % M; /* generate 0 □ M-1 */
```

Solution

```
# include <stdio .h>
# include <stdlib .h>
# include <time .h>
int main () {
    int myNum , yourNum ;
    srand ( time ( NULL )); /* Seed */
    myNum = 1 + rand () % 10; /* Pick a number */
    printf (" Guess my number ( between 1 and 10): ");
    scanf ("%d", & yourNum );
    if ( yourNum < myNum ) {
        printf (" Your guess was too small .\n");
    } else if ( yourNum > myNum ) {
        printf (" Your guess was too high .\n");
    } else {
        printf (" You got it !\n");
    }
    printf ("The correct number was %d.\n", myNum );
return 0;
}
```

Exercise 6.5

- Write a program that reads in three integers. and then determine which one is the smallest, and display it.
- If the values are a, b, and c, there are four cases:
  - a is smallest if a < b and a < c
  - b is smallest if b < a and b < c
  - c is smallest if c < a and c < b
  - No smallest When?

Solution

```
# include <stdio .h>
int main () {
     int a, b, c, least ;
     printf (" Enter 3 integers : ");
     scanf ("%d , %d , %d", &a, &b, &c);
     if (a < b && a < c) least = a;
     else if (b < a && b < c) least = b;
     else if (c < b && c < a) least = c;
     else {
          printf (" No smallest value!\n");
          return 0;
     }
     printf (" Smallest is %d\n", least );
  return 0;
}
```

Exercise 6.6

- Alter the exercise6.2 by using Switch selection structure.
- Alter the exercise6.4 by using Switch selection structure.

Exercise 6.7

- Write a C program that does the following:
  - reads the type of a vehicle exiting a car park (C for car, B for bus and T for truck) and the number of hours spent in the car park.
  - calculates the parking fee given the following rates
    - Car: $0.70/hr for the first 2 hours; $2.50/hr after 2 hours
    - Bus: $1.50/hr for the first 2 hours; $2.00/hr after 2 hours
    - Truck: $2.50/hr for the first hour; $3.25/hr after 1 hour
  - prints a request for payment that states the total parking fee owed.

PARKING FEE

VEHICLE – TYPE: CAR

TIME: 5.5

REGULAR FEE: 2*0.7 = 1.4

OvERTIME : 3.5*2.5=7.5

TOTAL : 8.9

Thank you.

Solution

```
#include <stdio.h>

int main ()
{
   char vtype;
   int hours;
   float fee;
   printf("Enter the type of vehicle (C, B, T): ");
   scanf(" %c",&vtype);
   printf("Enter the number of hours spent in the car park: ");
   scanf(" %d",&hours);
   if (vtype == 'C')
   {
      if (hours > 2)
      {
            fee = 1.4 + (hours-2)*2.5;
      }
      else
      {
            fee = hours*0.7;
      }
   }
```

Solution

```
   else if (vtype == 'B')
{
   if (hours > 2)
   {
         fee = 3 + (hours-2)*2;
   }
   else
   {
         fee = hours*1.5;
   }
}
else // vtype == 'T'
{
   fee = 2.5;
   if (hours > 1)
   {
         fee += (hours-1)*3.25;
   }
}
   printf("Please pay %.2f\n",fee);
   return 0;
}
```

Exercise 6.8

- Ask users to enter the month, then program shows the number of days
  - Month of 31 days: 1, 3, 5, 7, 8, 10, 12
  - Month of 30 days: 4, 6, 9, 10
  - Month of 29 or 28 days: 2

Excercise 6.9

- Write a program that asks users to enter 03 edges of a triangle. After that, the program informs to users the type of the input triangle.
- The program should check the input from users
- Triangle types
  - normal triangle
  - isosceles right triangle
  - isosceles triangle
  - right triangle
  - equilateral triangle.

Homework 6.1

- Write a C program that does the following:
  - reads the type of a vehicle exiting a car park (C for car, B for bus and T for truck) and the number of hours spent in the car park.
  - calculates the parking fee given the following rates
    - Car: $0.70/hr for the first 2 hours; $2.50/hr after 2 hours
    - Bus: $1.50/hr for the first 2 hours; $2.00/hr after 2 hours
    - Truck: $2.50/hr for the first hour; $3.25/hr after 1 hour
  - prints a request for payment that states the total parking fee owed.

Expected Interface

PARKING FEE

VEHICLE – TYPE: CAR

TIME: 5.5

REGULAR FEE: 2*0.7 = 1.4

OvERTIME : 3.5*2.5=7.5

TOTAL : 8.9

Thank you.

Homework 6.2 Xổ số miền Bắc

- Viết chương trình yêu cầu người dùng chọn mua 1 vé xổ số có 6 chữ số. Nếu người dùng gõ số có ít hơn 6 thì các chữ số trái nhất sẽ là 0
- Sau đó chương trình tự động sinh ngẫu nhiên kết quả là 1 số có 6 chữ số. Nếu số sinh ra có ít hơn 6 chữ số thì các chữ số trái nhất sẽ là 0
  - Nếu trùng nhau cả 6 chữ số: thông báo trúng giải đặc biệt (3 tỷ)
  - Nếu trùng 5 chữ số (tính từ hàng đơn vị): giải nhất (200 triệu)
  - Nếu trùng 4 chữ số: giải nhì (100 triệu)
  - Trùng 3: giải ba (10 triệu). Trùng 2: giải khuyến khích 500 nghìn.
  - In ra kết quả trúng giải hay không và Giá trị giải thưởng.

Gợi ý giao diện

CHƯƠNG TRÌNH SXKT MIEN BAC

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1. Mua ve
2. Quay so
3. So ket qua
4. Thoat

Homework 6.3

- Add a feature to program 6.2: buying cinema ticket. The policy is as follows:
  - Weekend: Basic price is $10 while other days basic price is $7.
  - Child: reduce 50%
  - Senior Citizen: reduce 30%
- Print the cinema ticket in this form
  - Movie: Avatar
  - Class: Child
  - Date: Weekend
  - Price: $5
- Make a improve version that asks:
  - number of people (<=3)
  - age of each person

  then, print the bill

Expected Interface

- GALAXY CINEMA BILLING
- Number of persons: 3
- Age of No 1: 12
- Age of No 2: 33
- Age of No 3: 67
- Title of movie: Gone with the wind.
- WEEK(E)ND OR WEE(D)AY?: E
- Payment: 10*50%+10+10*70% =..