EECS 10: Computational Methods in Electrical and Computer Engineering

Lecture 10

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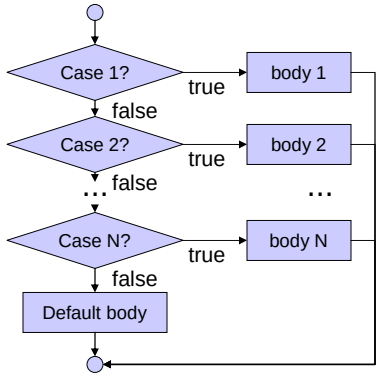
Lecture 10: Overview

- Structured Programming
  - Conditional statements
    - **`switch`** statement
    - Example **`Grade2.c`**
- Formatted output
  - Formatting of integral values
  - Formatting of floating-point values
  - Example **`Formatting.c`**

Structured Programming

- Selection: **`switch`** statement
  - Flow chart:



Example:

```
switch(LetterGrade)
{ case 'A':
   { printf("Excellent!");
     break; }
  case 'B':
  case 'C':
  case 'D':
   { printf("Passed.");
     break; }
  case 'F':
   { printf("Failed!");
     break; }
  default:
   { printf("Invalid grade!");
     break; }
} /* hctiws */
```


Example Program

- Grade calculation: **`Grade2.c`** (part 1/3)

```
/* Grade2.c: convert score into letter grade    */
/* author: Rainer Doemer                        */
/* modifications:                               */
/* 10/18/04 RD  use 'switch' statement          */
/* 10/17/04 RD  initial version                 */

#include <stdio.h>

/* main function */

int main(void)
{
   /* variable definitions */
   int  score = 0;
   char grade;

   /* input section */
   while (score < 1 || score > 100)
      { printf("Please enter your score (1-100): ");
        scanf("%d", &score);
       } /* elihw */
...
```

Example Program

- Grade calculation: **`Grade2.c`** (part 2/3)

```
.../* computation section */
    switch (score / 10)
      { case 10:
        case 9:
           { grade = 'A';
             break; }
        case 8:
           { grade = 'B';
             break; }
        case 7:
           { grade = 'C';
             break; }
        case 6:
           { grade = 'D';
             break; }
        default:
           { grade = 'F';
             break; }
       } /* hctiws */
...
```


Example Program

- Grade calculation: **`Grade2.c`** (part 3/3)

```
...

   /* output section */
   printf("Your letter grade is %c.\n", grade);

   /* exit */
   return 0;
} /* end of main */

/* EOF */
```

Example Program

- Example session: **`Grade2.c`**

```
% cp Grade.c Grade2.c
% vi Grade2.c
% gcc Grade2.c -o Grade2 -Wall -ansi
% Grade2
Please enter your score (1-100): 111
Please enter your score (1-100): 99
Your letter grade is A.
% Grade2
Please enter your score (1-100): 85
Your letter grade is B.
% Grade2
Please enter your score (1-100): 71
Your letter grade is C.
% Grade2
Please enter your score (1-100): 69
Your letter grade is D.
% Grade2
Please enter your score (1-100): 55
Your letter grade is F.
%
```


Formatted Output

- Formatted output using **`printf()`**
  - standard format specifiers for integral values
    - **`unsigned long long`** **`%llu`**
    - **`long long`** **`%lld`**
    - **`unsigned long`** **`%lu`**
    - **`long`** **`%ld`**
    - **`unsigned int`** **`%u`**
    - **`int`** **`%d`**
    - **`short`** **`%hd`**
  - standard format specifiers for floating point values
    - **`long double`** **`%Lf`**
    - **`double`** **`%f`**
    - **`float`** **`%f`**

Formatted Output

- Detailed formatting sequence for integral values
  - **% *flags width length conversion***
  - *flags*
    - (none) standard formatting (right-justified)
    - **-** left-justified output
    - **+** leading plus-sign for positive values
    - **0** leading zeros
  - field *width*
    - (none) minimum number of characters needed
    - integer width of field to be filled with output
  - *length* modifier
    - (none) **int** type
    - **h** **short int** type
    - **l** **long int** type
    - **ll** **long long int** type
  - *conversion* specifier
    - **d** signed decimal value
    - **u** unsigned decimal value
    - **o** (unsigned) octal value
    - **x** (unsigned) hexadecimal value using characters **0-9**, **a-f**
    - **X** (unsigned) hexadecimal value using characters **0-9**, **A-F**

Formatted Output

- Detailed formatting sequence for floating-point values
  - **% *flags width precision length conversion***
  - *flags*
    - (none) standard formatting (right-justified)
    - **-** left-justified output
    - **+** leading plus-sign for positive values
    - **0** leading zeros
  - field *width*
    - (none) minimum number of characters needed
    - integer width of field to be filled with output
  - *precision*
    - (none) default precision (e.g. 6)
    - **.**int number of digits after decimal point (for **f**, **e**, or **E**), maximum number of significant digits (for **g**, or **G**)
  - *length* modifier
    - (none) **float** or **double** type
    - **L** **long double** type
  - *conversion* specifier
    - **f** standard floating-point notation (fixed-point)
    - **e** or **E** exponential notation using (**e** or **E**)
    - **g** or **G** standard or exponential notation (using **e** or **E**)

Formatted Output

- Program example: **`Formatting.c`** (part 1/2)

```
/* Formatting.c: formatted output demo          */
/* author: Rainer Doemer                        */
/* modifications:                               */
/* 10/19/04 RD  initial version                 */

#include <stdio.h>

/* main function */

int main(void)
{
  /* output section */
  printf("42 formatted as |%%d|:   |%d|\n", 42);
  printf("42 formatted as |%%8d|:  |%8d|\n", 42);
  printf("42 formatted as |%%-8d|: |%-8d|\n", 42);
  printf("42 formatted as |%%+8d|: |%+8d|\n", 42);
  printf("42 formatted as |%%08d|: |%08d|\n", 42);
  printf("42 formatted as |%%x|:   |%x|\n", 42);
  printf("42 formatted as |%%o|:   |%o|\n", 42);
...
```


Formatted Output

- Program example: **`Formatting.c`** (part 2/2)

```
...
  printf("\n");
  printf("123.456 formatted as |%%f|:     |%f|\n", 123.456);
  printf("123.456 formatted as |%%e|:     |%e|\n", 123.456);
  printf("123.456 formatted as |%%g|:     |%g|\n", 123.456);
  printf("123.456 formatted as |%%12.4f|: |%12.4f|\n",
                                                  123.456);
  printf("123.456 formatted as |%%12.4e|: |%12.4e|\n",
                                                  123.456);
  printf("123.456 formatted as |%%12.4g|: |%12.4g|\n",
                                                  123.456);

  /* exit */
  return 0;
} /* end of main */

/* EOF */
```

Formatted Output

- Example session: **`Formatting.c`**

```
% vi Formatting.c
% gcc Formatting.c -o Formatting -Wall -ansi
% Formatting
42 formatted as |%d|:   |42|
42 formatted as |%8d|:  |      42|
42 formatted as |%-8d|: |42      |
42 formatted as |%+8d|: |     +42|
42 formatted as |%08d|: |00000042|
42 formatted as |%x|:   |2a|
42 formatted as |%o|:   |52|

123.456 formatted as |%f|:     |123.456000|
123.456 formatted as |%e|:     |1.234560e+02|
123.456 formatted as |%g|:     |123.456|
123.456 formatted as |%12.4f|: |    123.4560|
123.456 formatted as |%12.4e|: |  1.2346e+02|
123.456 formatted as |%12.4g|: |       123.5|
%
```