



C Programming – Lecture II

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Example – 7 (Previous Week)

- Write a program that asks user to write radius (r) and height (h) of a cylinder and then calculates:
 - Volume ($V = \pi r^2 h$)
 - Side area ($2\pi r h$)
 - Total area ($2\pi r^2 + 2\pi r h$)



Example – 7 (Previous Week)

```
#include<stdio.h> #include<conio.h>
#define PI 3.1415962
main()      {
int r,h;      double V,SA,TA;
printf("Clynder calculator.\n");
printf("Write radius and height: "); scanf("%d %d",&r,&h);
V=PI*r*r*h; SA=2*PI*r*h;      TA=2*PI*r*(r+h);
printf("Volume: %4.2f, Side area: %4.2f, Total area:
%4.2f",V,SA,TA);
getch();
return(0); }
```



C Data Types

Data Type	Meaning	Storage Space	Format	Range of Values
char	A character	1 byte	%c	ASCII character set
int	An integer	2 bytes	%d	-32768 to +32767
float	A single precision floating point number	4 bytes	%f	-3.4×10^{38} to $+3.4 \times 10^{38}$
double	A double precision floating point number	8 bytes	%lf	-1.7×10^{308} to $+1.7 \times 10^{308}$
void	valueless or empty	0 byte	-	-

float: 7 significant digits

double: 15-16 significant digits



The if/else Selection Structure

- **if** : Only performs an action if the condition is **true**.
- **if/else** : A different action when condition is **true** than when condition is **false**
- Relational and logical operators: <, >, <=, >=, ==, !=, &&, ||
- Psuedocode:
 - If student's average grade is smaller than 60
Print "Failed"
 - else Print "Success"
- C code:

```
if ( avg < 60 )
    printf("Failed");
else
    printf("Success");
```



Relational Operators

Operator	Meaning
==	Equal to
!=	Not equal to
<	Less than
<=	Less than or equal to
>	Greater than
>=	Greater than or equal to



The if/else Selection Structure

Compound statement:

➤ Set of statements within a pair of braces

➤ Example:

```
if ( avg < 60 )
    printf("Failed");
else {
    printf("Success \n ");
    printf("You must take this course
again.\n"); }
```

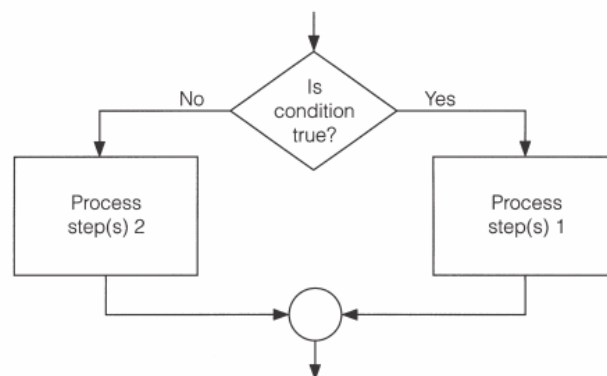
➤ Without the braces,

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

 would be automatically executed

Pseudocode and Flowchart for a Decision Structure

```
If condition is true Then
    Process step(s) 1
Else
    Process step(s) 2
End If
```





Example - 1

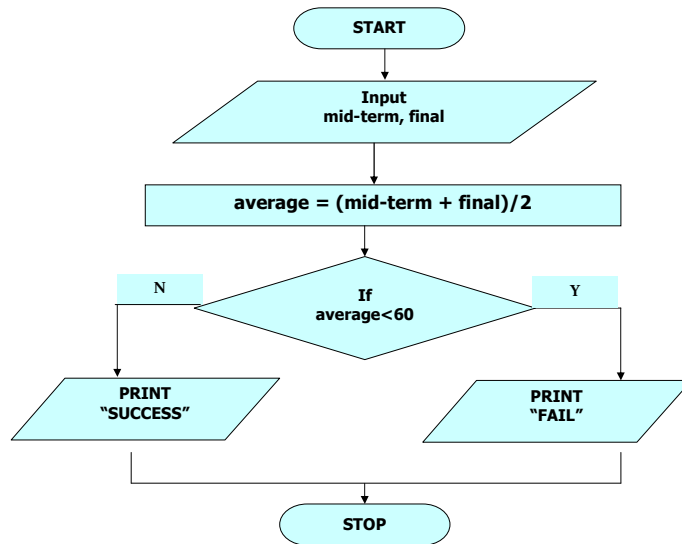
- Write an algorithm to determine a student's average grade and indicate whether he is successful or not.
- The **average** grade is calculated as the average of **mid-term** and **final** grades.
- Student will be successful if his average grade is greater or equals to 60.



Detailed Algorithm

- 1. Step: Input **mid-term** and **final**
- 2. Step: **average** = (**mid-term** + **final**)/2
- 3. Step: if (**average** < 60) then
 Print "FAIL"
 else
 Print "SUCCESS"
endif

Flowchart



Example – 1: C Codes

```
#include<stdio.h>
#include<conio.h>
main() {
    int m,f;      /* m: mid-term grade , f: final grade*/
    double avg;  /* avg: average grade*/
    printf("Write mid-term and final grades: ");
    scanf("%d %d",&m,&f);
    avg=(m+f)/2;
    if (avg<60) printf("Fail");
    else printf("Success");
    getch();    return(0);  }
```



Equality (==) and Assignment (=) Operators

- Do not confuse Equality (==) with Assignment (=) Operators in `if` statements.

```
if ( avg == 100 )  
    printf( "You get max average" );
```

- Correct usage

```
if ( avg = 100 )  
    printf( "You get max average" );
```

- This *sets* `avg` to 100
- Since 100 is nonzero, so expression is `true`, and this line is executed no matter what the value of `avg` was
- Logic error!!!



Example - 2

- Write a program which asks user to write an integer value and then computer decides whether this number is
 - odd number
- or
 - even number.



Example - 2

```
#include <stdio.h>
#include <conio.h>
main()
{
int i;
printf("Write an integer: ");
scanf("%d",&i);
if (i%2==1) printf("Odd number");
else printf("Even number");
getch();
return 0; }
```



Example - 3

- Write a program that asks user to write his/her weight and height.
- Then calculates mass body index (mbi).
- After that program displays a message with respect to the value of mbi.
 - if $mbi < 18.5$ → Underweight
 - if $mbi < 25.0$ → Normal weight
 - if $mbi < 30.0$ → Slightly overweight
 - if $mbi < 35.0$ → Overweight
 - otherwise → Obesite warning



Example - 3

```
/* Body Mass Index Calculator written by Özgür ZEYDAN */
#include <stdio.h> #include <conio.h>
main()      {
double w,h, mbi; /* w: weight h: height mbi: body mass
index */
printf("*** Body Mass Index Calculator by Özgür ZEYDAN
*** \n");
printf("Write your weight in kilograms :");
scanf("%lf",&w);
printf("Write your height in meters :");
scanf("%lf",&h);
```



Example - 3

```
mbi=w/(h*h);
if (mbi<18.5) printf("Underweight");
else if (mbi<25.0) printf("Normal weight");
else if (mbi<30.0) printf("Slightly overweight");
else if (mbi<35.0) printf("Overweight");
else printf("Obesite warning");
getch();
return 0;
}
```



Math Library Functions

- Math library functions
 - perform common mathematical calculations
 - `#include <math.h>`
- Format for calling functions
 - `FunctionName (argument);`
 - `printf("%4.2f", sqrt(81.0));`
 - Calls function `sqrt`, which returns the square root of its argument
 - All math functions return data type `double`
 - Arguments may be constants, variables, or expressions



Example - 4

- Write a C program in order to solve quadratic equation.
 - Program ask values of "a" , "b" and "c"
 - Calculates delta
 - If $\text{delta} > 0$ then calculates x_1, x_2 display results
 - If $\text{delta} = 0$ then calculates x_1 display results
 - If $\text{delta} < 0$ then display "no real roots" message



Example - 4

```
/* Quadratic Equation Solver written by Özgür ZEYDAN */
#include <stdio.h>
#include <conio.h>
#include <math.h>
main()      {
int a,b,c;          /* a*x^2 + b*x + c =0 */
float d,x1,x2;     /* d: delta */
printf(" *** Quadratic Equation Solver by Özgür ZEYDAN ***
\n");
printf("Write a b c values: ");
scanf("%d %d %d",&a,&b,&c);
```



Example - 4

```
d=b*b-4*a*c;
if (d>0)      {
x1=(-b-sqrt(d))/(2*a);
x2=(-b+sqrt(d))/(2*a);
printf("X1 = %4.2f and X2 = %4.2f",x1,x2);  }
else if (d==0)    {
x1=(-b)/(2*a);
printf("X1 = X2 = %4.2f",x1);  }
else printf("No real root exists");
getch();
return 0;     }
```



Example – 4 with less coding

```
/* Quadratic Equation Solver written by Özgür ZEYDAN */
#include <stdio.h>
#include <conio.h>
#include <math.h>
main()      {
int a,b,c;      /* a*x^2 + b*x + c =0 */
float d;        /* d: delta */
printf(" *** Quadratic Equation Solver by Özgür ZEYDAN ***
\n");
printf("Write a b c values: ");
scanf("%d %d %d",&a,&b,&c);
```



Example – 4 with less coding

```
d=b*b-4*a*c;
if (d>=0)
printf("X1 = %4.2f and X2 = %4.2f", (-b-sqrt(d))/(2*a), (-
b+sqrt(d))/(2*a));
else printf("No real root exists");
getch();
return 0;
}
```



Defining Macros

- `#define cube(x) x*x*x`
- If you use,
- `y = cube(a)+b;`
- This statement will be replaced by,
- `y = a*a*a + b;`



Some Useful Macros

- Mean:
 - `#define mean(x,y) ((x)+(y))/2`
- Maximum number:
 - `#define max(x,y) ((x)>(y) ? (x) : (y))`
- Minimum number:
 - `#define min(x,y) ((x)<(y) ? (x) : (y))`
- Logical expression ? True action : False Action



Example – 5

- Write a C program that asks user to write two integers.
- Then, program displays **bigger number** and **smaller number**.



Example – 5

```
#include <stdio.h>
#include <conio.h>
#define max(x,y) ((x)>(y) ? (x) : (y))
#define min(x,y) ((x)<(y) ? (x) : (y))
main()    {
    int i,j;
    printf("Write two integers (space in between): ");
    scanf("%d %d",&i,&j);
    printf("Bigger number is %d\n",max(i,j));
    printf("Smaller number is %d",min(i,j));
    getch();
    return 0; }
```



The switch Multiple-Selection Structure

> switch

- Useful when a variable or expression is tested for all the values it can assume and different actions are taken.

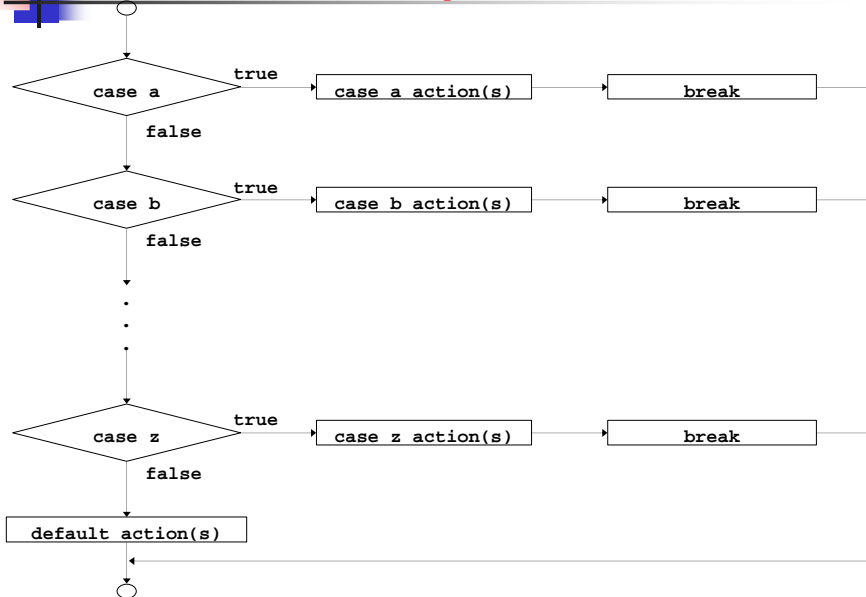
> Format :Series of case labels and an optional default case

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

- **break;** causes exit from structure



The switch Multiple-Selection Structure





Example – 6

- Rewrite odd – even number program by using `switch` function.



Example – 6

```
#include <stdio.h>
#include <conio.h>
main()    {
int i,j;
printf("Write an integer: ");
scanf("%d",&i);
j=i%2;
switch (j) {
case 0: printf("Even number"); break;
case 1: printf("Odd number");    }
getch();    return 0;    }
```


Example – 7

- Write a Calculator program with switch function.
- Program will ask operator (+ - * /) and make calculations.
- You may use ascii values of operators like:

```
char c1,c2;      /* c1: choice
                  c2: ascii code of c1 */
scanf("%s",&c1);
c2=(int)c1;
42 2A 052 &#42; *
43 2B 053 &#43; +
44 2C 054 &#44; /
45 2D 055 &#45; -
46 2E 056 &#46; .
47 2F 057 &#47; /
```

ASCII Table

Dec	Hx	Oct	Char	Dec	Hx	Oct	Html	Chr	Dec	Hx	Oct	Html	Chr	Dec	Hx	Oct	Html	Chr
0	0	000	NUL (null)	32	20	040	 	Space	64	40	100	@	@	96	60	140	`	^
1	1	001	SOH (start of heading)	33	21	041	!	!	65	41	101	A	A	97	61	141	a	a
2	2	002	STX (start of text)	34	22	042	"	"	66	42	102	B	B	98	62	142	b	b
3	3	003	ETX (end of text)	35	23	043	#	#	67	43	103	C	C	99	63	143	c	c
4	4	004	EOT (end of transmission)	36	24	044	$	\$	68	44	104	D	D	100	64	144	d	d
5	5	005	ENQ (enquiry)	37	25	045	%	%	69	45	105	E	E	101	65	145	e	e
6	6	006	ACK (acknowledge)	38	26	046	&	&	70	46	106	F	F	102	66	146	f	f
7	7	007	BEL (bell)	39	27	047	'	'	71	47	107	G	G	103	67	147	g	g
8	8	010	BS (backspace)	40	28	050	((72	48	110	H	H	104	68	150	h	h
9	9	011	TAB (horizontal tab)	41	29	051))	73	49	111	I	I	105	69	151	i	i
10	A	012	LF (NL line feed, new line)	42	2A	052	*	*	74	4A	112	J	J	106	6A	152	j	j
11	B	013	VT (vertical tab)	43	2B	053	+	+	75	4B	113	K	K	107	6B	153	k	k
12	C	014	FF (NP form feed, new page)	44	2C	054	,	,	76	4C	114	L	L	108	6C	154	l	l
13	D	015	CR (carriage return)	45	2D	055	-	-	77	4D	115	M	M	109	6D	155	m	m
14	E	016	SO (shift out)	46	2E	056	.	.	78	4E	116	N	N	110	6E	156	n	n
15	F	017	SI (shift in)	47	2F	057	/	/	79	4F	117	O	O	111	6F	157	o	o
16	10	020	DLE (data link escape)	48	30	060	0	0	80	50	120	P	P	112	70	160	p	p
17	11	021	DC1 (device control 1)	49	31	061	1	1	81	51	121	Q	Q	113	71	161	q	q
18	12	022	DC2 (device control 2)	50	32	062	2	2	82	52	122	R	R	114	72	162	r	r
19	13	023	DC3 (device control 3)	51	33	063	3	3	83	53	123	S	S	115	73	163	s	s
20	14	024	DC4 (device control 4)	52	34	064	4	4	84	54	124	T	T	116	74	164	t	t
21	15	025	NAK (negative acknowledge)	53	35	065	5	5	85	55	125	U	U	117	75	165	u	u
22	16	026	SYN (synchronous idle)	54	36	066	6	6	86	56	126	V	V	118	76	166	v	v
23	17	027	ETB (end of trans. block)	55	37	067	7	7	87	57	127	W	W	119	77	167	w	w
24	18	030	CAN (cancel)	56	38	070	8	8	88	58	130	X	X	120	78	170	x	x
25	19	031	EM (end of medium)	57	39	071	9	9	89	59	131	Y	Y	121	79	171	y	y
26	1A	032	SUB (substitute)	58	3A	072	:	:	90	5A	132	Z	Z	122	7A	172	z	z
27	1B	033	ESC (escape)	59	3B	073	;	;	91	5B	133	[[123	7B	173	{	{
28	1C	034	FS (file separator)	60	3C	074	<	<	92	5C	134	\	\	124	7C	174	|	
29	1D	035	GS (group separator)	61	3D	075	=	=	93	5D	135]]	125	7D	175	}	}
30	1E	036	RS (record separator)	62	3E	076	>	>	94	5E	136	^	^	126	7E	176	~	~
31	1F	037	US (unit separator)	63	3F	077	?	?	95	5F	137	_	_	127	7F	177		DEL

Source: www.LookupTables.com



Example – 7

```
/* Simple Calculator by Özgür ZEYDAN */
#include <stdio.h> #include <conio.h>
main()      {
float n1,n2;      /* n1: number 1 , n2: number 2 */
char c1,c2;      /* c1: choice , c2: ascii code of c1 */
printf("Simple Calculator by Özgür ZEYDAN");
printf("Write two numbers: ");
scanf("%f %f",&n1,&n2);
printf("Select choice (+ - * /) ");
scanf("%s",&c1);
c2=(int)c1;
```



Example – 7

```
switch (c2) {
case 43: printf("%0.0f + %0.0f = %0.0f",n1,n2,n1+n2);
break;
case 45: printf("%0.0f - %0.0f = %0.0f",n1,n2,n1-n2);
break;
case 42: printf("%0.0f * %0.0f = %0.0f",n1,n2,n1*n2);
break;
case 47: if (n2==0) printf("Division by zero error!");
else printf("%4.2f / %4.2f = %5.3f",n1,n2,n1/n2);
break;
default: printf("Wrong operator!.."); break;   }
getch();      return 0;      }
```