



Overview of C

Computer Science Department

Comp 1310

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Motivation

//C program for area of circle Comment #include <stdio.h> // standard header file (contains printf and scanf) #define PI 3.141 //we use define for creating constant int main() // int, float , and return (reserved words)

float r, a; // r, a are variables
printf("Please enter the radius: "); //standard identifier
scanf("%f", &r); //standard identifier
a = PI * r * r; // = , *,{, } special symbols
printf("%f\n", a); // standard identifier
return 0;

{

Preprocessor directives

- #include
 - gives a program access to a library
- <stdio.h>
 - standard header file
 - contains information about standard input and output functions such as scanf and printf

Preprocessor directives

- #include <stdio.h>
 - notify the preprocessor that some names used in the program are found in <stdio.h>
- #define
 - using only data values that never change should be given names

Preprocessor directives

- Constant macro
 - a name that is replaced by a particular constant value
 - EX:
 - #define PI 3.141593

constant macro constant value

#define MAX_LENGTH 100

Comment

- Two types:
 - One-line comment //
 - Multiple-line comment /* */

Examples:

// This is a one-line comment

/* Hello, this is multiple-line comment*/

 Variable: a name associated with a memory cell whose value can change.

Examples: sum, x,y, result,....

- 1. A variable must consist only of letters, digits, and underscores.
- 2. A variable cannot begin with a digit.
- 3. A C reserved word cannot be used as a user variable.
- 4. A variable defined in a C standard library should not be redefined.

Reserved Words : A word that has special meaning in C for example: int, float, double, char, return ,...etc

Syntax Display for Declarations:

- Syntax :
 - int variable_list;
 - float variable_list;
 - double variable_list;
 - char variable_list;
- Examples :
 - int count, large;
 - float ans; or float ans=4.2;
 - double x, y, z; or double x=1.2,y=3.6,z=8.9;
 - char first_initial;

Data types:

- int (16 bit)
- float (32 bit)
- double (64 bit)

a real number has an integral part and a fractional part that are separated by a decimal point

Data types:

- char (8 bit)
 - represent an individual character value
 - include a letter, a digit, a special symbol
 - -ex. 'A' 'z' '9' '*' ':' '"' (

Invalid variables names

Invalid identifier	Reason Invalid
1Letter	begins with a digit
double	reserved word
int	reserved word
TWO*FOUR	character * not allowed
joe's	character ' not allowed

To remove the ambiguity

Reserved Words	Standard Identifiers	User-Define Identifiers
int	printf	KMS_PER_MILE
void	scanf	miles
float		kms
double		sum
return		sum

NOTE: <u>Sum</u>, <u>sum</u>, <u>SUM</u> are viewed by the compiler as different identifiers

Placeholders in format strings

Placeholder	Variable Type	Function Use
% c	char	printf / scanf
%d	int	printf / scanf
%f	float	printf / scanf
% f	double	printf
%lf	double	scanf

Placeholders in format strings

int sum ;
float a, r ;
double num;

let sum=2 a=3.2 , r=5,2 num= 76.2232

- printf ("The area is %f", a);
- scanf(" %f ",&r);
- printf ("the result is %d", sum);
- scanf ("%lf",& num);
- printf ("the number is %f", num)

Arithmetic Operator	Meaning	Examples
+	addition	5 + 2 is 7
	subtraction	5 - 2 is 3
*	multiplication	5 * 2 is 10
/	division	5 / 2 is 2
%	Remainder or Mod	5 % 2 is 1

Results of / and % operations

int / int = int2/15=012/3=4, 9/8=1 16/3 = 5int/float =float, float/int=float 4/0 undefined float/float=float 2% 5 = 29/8.0=1.125000 5% 4 = 19.0/8=1.125000 15 % 0 undefined 9.0/8.0=1.125000



• Example:

double k,m; k= 9/6; m=9/6.0;

printf("k=%f \nm= %f", k,m);

Output:

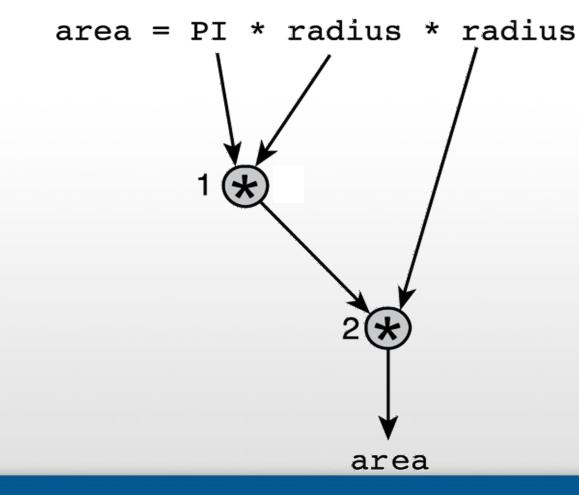
k=1.000000 m=1.500000

Precedence Rules:

- **(**)
- * / %
- + -

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Example 1 : Evaluate area = PI * radius * radius



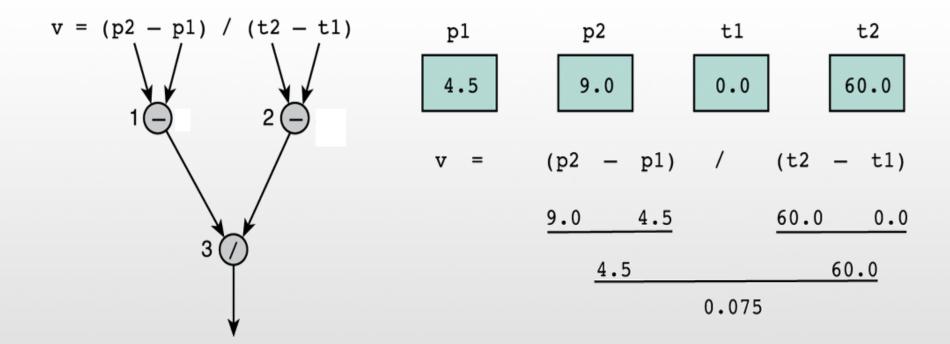
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Example 1 : Evaluate area = PI * radius * radius Let PI= 3.14159 , radius=2.0

area	=	PI	*	radius	*	radius
		3.14159		2.0		2.0
	6.28318					
				12	.566	36

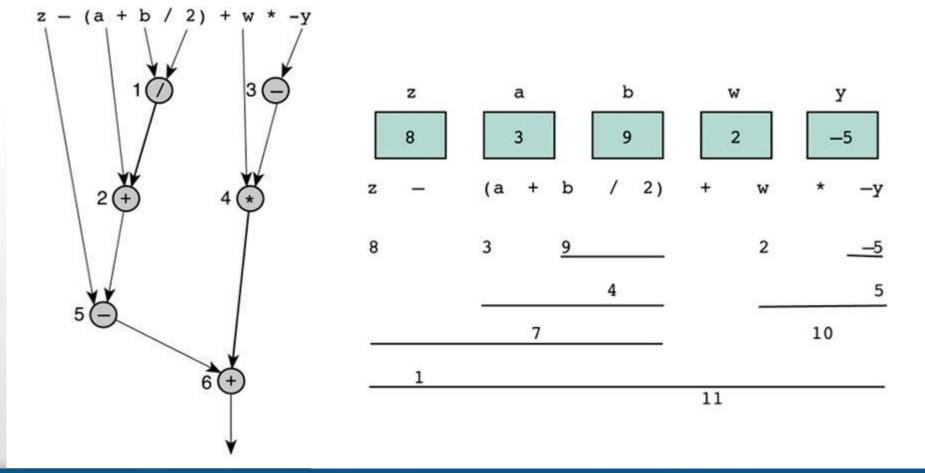
Example 1 : Evaluate
$$v = \frac{p2-p1}{t2-t1}$$

let P1=4.5 ,P2=9.0, t1=0.0, t2=60.0



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Example 1 : Evaluate $z - (a + b / 2) + w^* - y$



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Mathematical Formula as C Expression

Mathematical Formula	C Expression
b ² -4ac	b * b - 4 * a * c
a + b - c	a + b - c
a+b c+d	(a + b) / (c + d)
1 1+x ²	1 / (1 + x * x)
a x -(b + c)	a * -(b + c)



Write a complete C program that prompts the user to enter the radius of a circle and displays the circumference. Circumference= $2 \pi r$

```
#include <stdio.h>
#define PI 3.14159
int main(void)
```

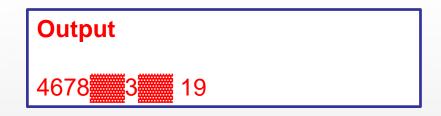
```
Int
{
```

```
double radius, circum;
printf("Please enter radius of circle> ");
scanf("%lf", &radius);
circum = 2 * PI * radius;
printf("The circumference is %.2f.\n", circum);
return 0;
```

Formatting output

int x= 4678, y=3, z=19

1. printf ("%d %d %d", x,y,z)



2. printf ("%7d %5d %6d", x,y,z)



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Formatting output

float x=56.2757 y=2.3849 z=114.2;
 printf ("%8.3f%-7.2f%7.4f",x,y,z);

56.276 2.38 114.2000

 double a= 38.56, b= 201.117; printf("Is it%6.1f%9.4f", a, b);

Is it 38.6 201.1170

• float x=333.256;

printf("%0.2f",x); 333.26



Value	Format	Displayed Output	Value	Format	Displayed Output
234	% 4d	234	-234	%4d	-234
234	%5d	234	-234	%5d	-234
234	% 6 d	234	-234	% 6d	-234
234	%1d	234	-234	%2d	-234

Formatting output (Practice)

Value	Format	Displayed Output	Value	Format	Displayed Output
3.14159	%5.2f	3.14	3.14159	%4.2f	3.14
3.14159	%3.2f	3.14	3.14159	%5.1f	3.1
3.14159	%5.3f	3.142	3.14159	% 8. 5f	3.14159
.1234	%4.2f	0.12	006	%4.2f	-0.01
006	%8.3f	-0.006	006	% 8. 5f	-0.00600
006	%.3f	-0.006	-3.14159	% . 4f	-3.1416

Extra Exercises

1. Which of the following identifiers are (a) C reserved words, (b) standard identifiers, (c) conventionally used as constant macro names, (d) other valid identifiers, and (e) invalid identifiers?

voidMAX_ENTRIESdoubletimeGSue'sreturnprintfxyz123part#2"char"#insertthis_is_a_long_one

2. Do a step-by-step evaluation of the expressions that follow if the value of celsius is 38.1 and salary is 38450.00.

- 1.8 * Celsius + 32.0
- (salary 5000.00) * 0.20 + 1425.00

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- 1.8 * Celsius + 32.0
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Example

```
Write a program to reverse any two digits
number? (<u>check slide 15</u>, Algorithm lecture)
#include <stdio.h>
int main()
Ł
    int num;
    int rem;
    int rev;
    int tens;
    printf("Please enter two digits number");
    scanf ("%d", &num);
    tens= num / 10;
    rem=num % 10;
    rev= rem * 10;
    rev= rev+ tens;
    printf ("the result is %d", rev);
    return 0;
```

}

Common programming errors

- Syntax Errors
 - is a mistake in the syntax.

Ex:

- missing semicolon
- undeclared variable
- last comment is not closed because of blank in */ close-comment sequence

Common programming errors

- Logic Errors
 - an error caused by following an incorrect algorithm.
 - Ex:

sum = x-y (minus instead of plus)



Common programming errors

- Run-Time Errors
 - an attempt to perform an invalid operation, detected during program execution.

Ex:

result= x / 0 (undefined)



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Common programming errors (Practice) A Program with a syntax errors

```
221 /* Converts distances from miles to kilometers. */
222
223 #include <stdio.h>
                                /* printf, scanf definitions
                                                                */
266 #define KMS PER MILE 1.609 /* conversion constant
                                                                */
267
268 int
269 main(void)
270 {
271
          double kms
272
273
          /* Get the distance in miles. */
274
          printf("Enter the distance in miles> ");
***** Semicolon added at the end of the previous source line
275
          scanf("%lf", &miles);
***** Identifier "miles" is not declared within this scope
***** Invalid operand of address-of operator
276
277
          /* Convert the distance to kilometers. */
278
          kms = KMS PER MILE * miles;
***** Identifier "miles" is not declared within this scope
279
280
          /* Display the distance in kilometers. * /
281
          printf("That equals %f kilometers.\n", kms);
282
283
          return (0);
284 }
***** Unexpected end-of-file encountered in a comment
***** "}" inserted before end-of-file
```

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Common programming errors (Practice) A Program with a run-time error

```
111 #include <stdio.h>
262
263 int
264 main(void)
265 {
          int
                 first, second;
266
267
          double temp, ans;
268
269
          printf("Enter two integers> ");
270
          scanf("%d%d", &first, &second);
271
          temp = second / first;
272
          ans = first / temp;
273
          printf("The result is %.3f\n", ans);
274
275
          return (0);
276 }
Enter two integers> 14 3
Arithmetic fault, divide by zero at line 272 of routine main
```

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Type conversion through casts

- type cast
 - converting an expression to a different type by writing the desired type in parentheses in front of the expression
- Example 1: n = (int)(9 * 0.5);

The value of n is 4



Type conversion through casts

Using Cast	Without Cast integer division would cause the loss of the fractional part of the mean		
<pre>#include <stdio.h></stdio.h></pre>	<pre>#include <stdio.h></stdio.h></pre>		
<pre>int main() {</pre>	<pre>int main() {</pre>		
<pre>int sum = 17, count = 5; double mean; mean = (double) sum / count; printf("Value of mean : %f\n", mean); return 0;</pre>	<pre>int sum = 17, count = 5; double mean; mean = sum / count; printf("Value of mean : %f\n", mean); return 0;</pre>		
}	}		

Value of mean : 3.400000

Value of mean : 3.000000

Find more examples: <u>http://www.tutorialspoint.com/cprogramming/c_type_casting.htm</u>

Escape sequences

Escape Sequence causes the program to escape from the normal interpretation of a string, so that the next character is recognized as having a special meaning. The back slash "\" character is called the "**Escape Character**".

The escape sequence includes the following: \n => new line \t => tab \r => carriage return \" => double quotations \\ => back slash etc.

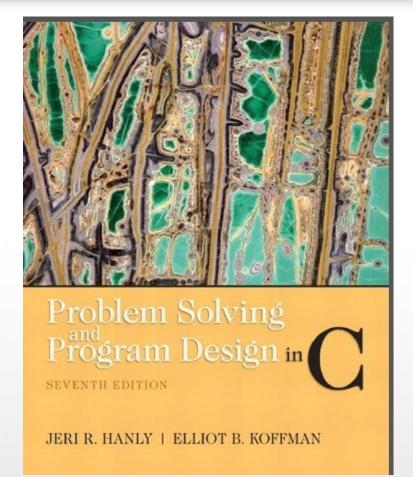
Extra Exercises

- What will be the output of the printf statement printf("hello\ryou");
- 2) Evaluate the following formulas:
 - 7 15 / 4
 - 6 * 5 / 10
 - 2 4 * 3 + 26 / 2
- 3) Find the value of x after applying the casting
 - x= (double) (r/t) , r=10, t=3
 - x= (double) r/t , r=10, t=3
 - x= r/(double)t , r=10, t=3



"Success is the sum of small efforts, repeated day in and day out." Robert Collier





Reference: Problem Solving & Program Design in C

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