Introduction to C

CSE 2031

Fall 2011

History

- Widely used, powerful, and fast.
- Both started at AT&T Bell Labs.
- UNIX was written in assembly, later changed to C.
- Many variants of UNIX.

C vs. Java

- Java-like (actually Java has a C-like syntax), some differences
- No //, only /*   */ multi-line and no nesting
- No garbage collection
- No classes
- No exceptions (try … catch)
- No type strings

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First C Program

```
#include <stdio.h>
main() {
   printf(“hello, world \n”);
}
```

Note: **`#include <filename.h>`** replaces the line by the actual file before compilation starts.

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Special Characters

\n	New line
\t	Tab
\”	Double quote
\\	The \ character
\0	The null character
\’	Single quote

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More Examples

- We will discuss more programs given in Chapter 1 in class.
- We will then learn basic input and output in C.

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Basic Input and Output

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Basic I/O

- Every program has a *standard input* and *output.*
- Usually, keyboard and monitor, respectively.
- Can use > and < for redirection

```
printf(“This is a test  %d \n”, x)
scanf(“%x %d”, &x, &y)
```

%d	%s	%c	%f	%lf
integer	string	character	float	double precision

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getchar( ) (7.1)

- To read one character at a time from the *standard input* (the keyboard by default):

  `int getchar(void)`

- returns the next input char each time it is called;
- returns EOF when it encounters end of file.
  - EOF input: Ctrl-d (Unix) or Ctrl-z (Windows).
  - EOF value defined in <stdio.h> is -1.

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putchar(c) (7.1)

- Puts the character c on the *standard output* (the screen by default).

  `int putchar(int)`

- returns the character written;
- returns EOF if an error occurs.

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Example

```
#include <stdio.h>
#include <ctype.h>
main() /* convert input to lower case*/
{
 int c;
 c = getchar();
 while ( c != EOF ) {
  putchar( tolower(c) );
 c = getchar();
 }
 return 0;
}
```

Example: more compact code

```
#include <stdio.h>
#include <ctype.h>

main() /* convert input to lower case*/
{
 int c;
 while ((c = getchar()) != EOF)
  putchar(tolower(c));
 return 0;
}
```

I/O Redirection

`prog < infile`

- prog reads characters from infile instead of the standard input.

`prog > outfile`

- prog writes to outfile instead of the standard output.

`otherprog | prog`

- Output from otherprog is the input to prog.

`prog | anotherprog`

- puts the standard output of prog into the standard input of anotherprog.

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printf( ) (7.2)

```
int printf(char *format, arg1, arg2, ...);
```

- converts, formats, and prints its arguments on the standard output under control of the `format`.
- returns the number of characters printed (usually we are not interested in the returned value).

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printf( ) Examples

```
printf(":%s:",        "hello, world");
printf(":%10s:",      "hello, world");
printf(":%.10s:",     "hello, world");
printf(":%-10s:",     "hello, world");
printf(":%.15s:",     "hello, world");
printf(":%-15s:",     "hello, world");
printf(":%15.10s:",   "hello, world");
printf(":%-15.10s:",  "hello, world");
```

```
:%s:          :hello, world:
:%10s:        :hello, world:
:%.10s:       :hello, wor:
:%-10s:       :hello, world:
:%.15s:       :hello, world:
:%-15s:       :hello, world   :
:%15.10s:     :     hello, wor:
:%-15.10s:    :hello, wor     :
```

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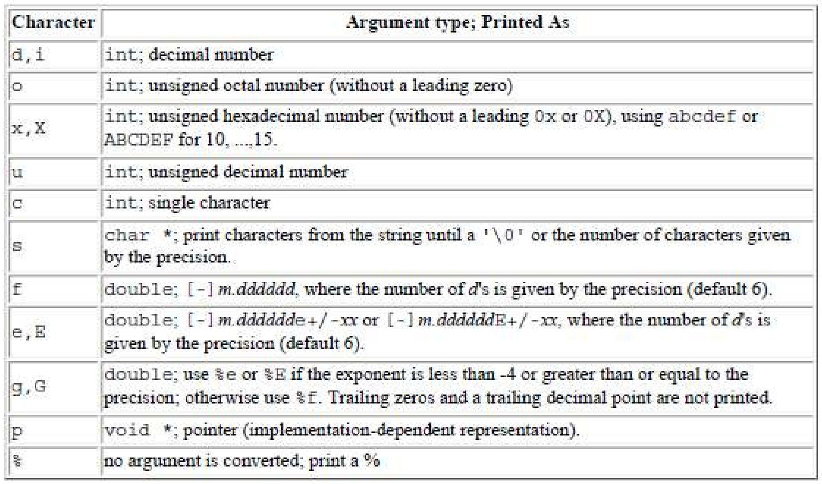
printf Conversions



Character	Argument type; Printed As
d,i	int; decimal number
o	int; unsigned octal number (without a leading zero)
x,X	int; unsigned hexadecimal number (without a leading 0x or 0X), using abcdef or ABCDEF for 10, ...,15.
u	int; unsigned decimal number
c	int; single character
s	char *; print characters from the string until a '\0' or the number of characters given by the precision.
f	double; [-] *m.dddddd*, where the number of *d*'s is given by the precision (default 6).
e,E	double; [-] *m.dddddd*e+/-*xx* or [-] *m.dddddd*E+/-*xx*, where the number of *d*'s is given by the precision (default 6).
g,G	double; use %e or %E if the exponent is less than -4 or greater than or equal to the precision; otherwise use %f. Trailing zeros and a trailing decimal point are not printed.
p	void *; pointer (implementation-dependent representation).
%	no argument is converted; print a %

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Output Formatting with printf( )

- A **minus sign**, which specifies **left adjustment** of the converted argument.
- A number that specifies the **minimum field width**. The converted argument will be printed in **a field at least this wide**. If necessary it will be padded on the left (or right, if left adjustment is called for) to make up the field width.
- A **period**, which **separates the field width from the precision**.
- A number, the **precision**, that specifies the **maximum number of characters to be printed from a string**, or the **number of digits after the decimal point** of a floating-point value, or the **minimum number of digits for an integer**.

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scanf( ) (7.4)

- scanf( ) is the input analog of printf( ).

- To read an integer:

```
int num;
scanf("%d”, &num);
```

- `&num` is a pointer to `num`.

- To read a char and a float:

```
char c; float f;
scanf("%c %f”, &c, &f);
```

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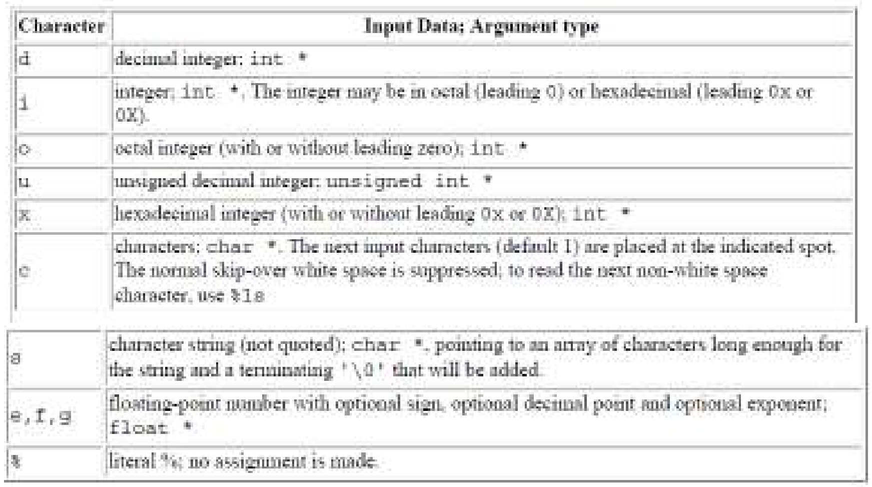
scanf Conversions



Character	Input Data; Argument type
`d`	decimal integer: `int *`
`i`	integer; `int *`. The integer may be in octal (leading `0`) or hexadecimal (leading `0x` or `0X`).
`o`	octal integer (with or without leading zero); `int *`
`u`	unsigned decimal integer; `unsigned int *`
`x`	hexadecimal integer (with or without leading `0x` or `0X`); `int *`
`c`	characters; `char *`. The next input characters (default 1) are placed at the indicated spot. The normal skip-over white space is suppressed; to read the next non-white space character, use `%1s`
`s`	character string (not quoted); `char *`, pointing to an array of characters long enough for the string and a terminating `'\0'` that will be added.
`e,f,g`	floating-point number with optional sign, optional decimal point and optional exponent; `float *`
`%`	literal %; no assignment is made.

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scanf( )

```
int scanf(char *format, arg1, arg2, ...);
```

- reads characters from the standard input, interprets them according to the specification in `format`, and stores the results through the remaining arguments.
- stops when it exhausts its format string, or when some input fails to match the control specification.
- returns the number of successfully matched and assigned input items (e.g., to decide how many items were found).
- returns 0 if the next input character does not match the first specification in the format string (i.e., an error).
- On the end of file, EOF is returned.
- **Note: `arg1, arg2, ...` must be pointers!**

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Next time ...

- Types, Operators and Expressions (Chapter 2)

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