

EECS 2031

C

Footer Text 1/29/2020 1

Topics

- Functions
- User Interface

Footer Text 1/29/2020 2

C – A History

- In 1978 Brian Kernighn and Dennis Ritchie Published their "White" book. Became defacto standard for C known as K&R C.
- ANSI completed a standard for C approved in 1989 as ANSI X3.159-1989 known as C89 or C90 (ANSI-C).
- C99 became standard in ISO/IEC 9899:1999.

Footer Text 1/29/2020 3

Languages based on C

- C++: basically object oriented C
- Java: C syntax, much more restrictive + garbage collection
- C#:
- Perl: started as scripting language, overtime adopted many features of C

C

- Almost low level, small, permissive (assumes you know what are you doing) language.
- Efficient, portable, powerful, and flexible (from system programming to embedded systems).
- Can be error prone, difficult to understand (see next slide)

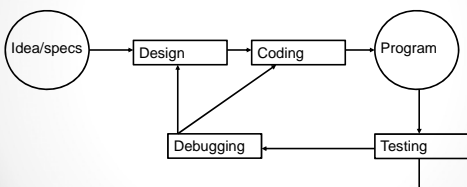
Obfuscated C

```
int v,i,j,k,l,s,a[99];
main(){
for(scanf("%d",&s);*a-s;v=a[j*=v]-a[i],k
=i<s,j+=(v=j<s&&!k&&!printf(2+"\n\n%c"
-(!l<<!j)," #Q"[l^v?(l^j)&l:2])&&+1 ||
a[i]<s&&v&&v-i+j&&v+i-j)&&!( l%=s),v||
(i==j?a[i+=k]=0:++a[i])>=s*k&&+a[--i])
;
}
```

Tips

- Use tools to make programs more reliable
- Use existing code library
- Adopt a sensible set of coding conventions
- Avoid tricks and overly complex code (do not ever do something like the Q8.c)

Software Development Cycle



Why Testing

- **Specifications = LAW**, you have to obey it.
- No changes (*improvement*) unless it is approved
- If in doubt, ask
- First create test cases, test, if error, debug, repeat
- Testing can show the presence of faults, not their absence -- Dijkstra
- Testing is very costly, in large commercial software 1-3 bugs per 100 line of code.

Why Testing

- 1990 AT&T long distance calls fail for 9 hours
 - Wrong location for C break statement
- 1996 Ariane rocket explodes on launch
 - Overflow converting 64-bit float to 16-bit integer
- 1999 Mars Climate Orbiter crashes on Mars
 - Missing conversion of English units to metric units
- Therac: A radiation therapy machine that delivered massive amount of radiations killing at lease 5 people
 - Among many others, the reuse of software written for a machine with hardware interlock. Therac did not have hardware interlock.

Why Testing

- Jan 13, 2005, LA Times
 - "A new FBI computer program designed to help agents share information to ward off terrorist attacks may have to be scrapped, forcing a further delay in a four-year, half-billion-dollar overhaul of its antiquated computer system... Sources said about \$100 million would be essentially lost if the FBI were to scrap the software..."*

Type of Errors

- Errors in program called bugs
- Testing is the process of looking for errors, debugging if found
- Three types of errors
 - Syntax
 - Run-time
 - Logic

Syntax Errors

- Mistakes by violating "grammar" rules
- Diagnosed by C compiler
- Must fix before compiler will translate code

Syntax Errors

<ul style="list-style-type: none"> • #include <stdio.h> • int main () • { • printf("Hello World"); • /* Next line will output a name! */ • printf(" Total is %d \n",total); • printf(" Final result is \n result); • } 	<pre>#include <stdio.h> int main() { printf("Hello World"); /*next line will output A name */ Printf("Total is %d \n",total); printf("Final result is \n",result); }</pre>
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Runtime Errors

- Violation of rules during execution of program
- Computer displays message during execution and execution is terminated
- Error message may help locating error

• E.g. X= 5 / 0;

Logical Errors

- Will not be detected by the compiler, may or may not produce an error message (if it results in a runtime error)
- Difficult to find
- Execution is complete but output is incorrect
- Programmer checks for reasonable and correct output

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Testing

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• Footer Text 1/29/2020 • 17

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• Footer Text 1/29/2020 • 18
