

# QUIZ

## DATA TYPES & SIZES

INT	4	CHAR	1
FLOAT	4	SHORT	2
DOUBLE	8	POINTER (32 BIT OS)	4
LONG LONG	8	BOOL* CS50.h	1

BYTES  $\xrightarrow{\quad}$   $\xrightarrow{\quad}$

1 BYTE  $\longleftrightarrow$  8 BITS

8	16	24	32	40	48	56	64	72	80
88	96	104	112	120	8 MULTIPLIED				

## RUN TIMES

WORST CASE = 0 SAME  
BEST CASE =  $\infty$

	0	$\infty$	$\Theta$
SELECTION	$\leftarrow n^2 \rightarrow$		
BUBBLE & INSERTION	$n^2$	$n$	$\times$
MERGE SORT	$\leftarrow n \log n \rightarrow$		
BINARY SEARCH	$\log n$	1	$\times$
LINEAR SEARCH	$n$	1	$\times$

## BITWISE OPERATORS

& - AND (same = 1)

| - OR (at least 1 = 1)

^ - XOR (ONLY DIFF = 1)

~ - NOT (INVERTS BIT)

signed int =  $2^{31} - 1$

unsigned int =  $2^{32}$

TWO'S COMPLEMENT

invert bits  
+ 1

<< >> - SHIFTS BIT # of spaces

Left or right (a = 1 a << 7  
a = 10000000)

SEEK\_SET

beg of file

SEEK\_CUR

current position

SEEK\_END

end of file

## CASTING

char c = 'a';

printf("%c : %i / %h", c, (int)c);

would print a: 97

casting

## BUFFER OVERFLOW

in parent routine's stack, there is a return address - where in memory the function should jump back to when it returns

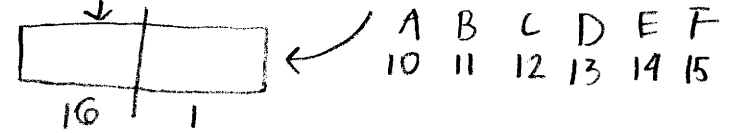
## BINARY TO DECIMAL TO HEX

128	64	32	16	8	4	2	1
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BINARY

(8)	(4)	(2)	(1)	8	+	2	1
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HEX



## ASCII VALUES

A - Z : 65 - 90

a - z : 97 - 122

A 132 = a  
 $a \wedge 32 = A$   
0 - 9 : 48 - 57  
(10 01111111)  
# in BINARY  
(SPACE) = 32

## TERMINAL COMMANDS

CD - CHANGE DIRECTORY

LS - LIST

RM [-f] - REMOVE [force]

SORT - sorts stdin to stdout

CAT - READS SPECIFIED FILE TO stdout

UNIQ - OUTPUTS UNIQUE LINES OF stdin to stdout

CP - COPY

CP THAT AS THIS

MV - MOVE (TO rename)

MV OLDNAME NEWNAME

## REDIRECTION

> - OUTPUTS TO A FILE

2> APPENDS BUT

>> - APPENDS TO A FILE

ONLY ERROR MESSAGES

< - input (use contents of file as input to program)

| - "pipe", take output from 1 program & use it as input for another

## COMPILERS

clang -o hello hello.c -lcs50 -werror  
names it hello instead of a.out  
links cs50 library  
makes all warnings errors

TWO PARTS = COMPILE WHICH GIVES A

• O FILE, a translation to machine language & LINKING which creates a single executable file from multiple object files (i.e. libraries)

## FILE

### I/O

\* ftell(FILE\*) = gives current position (from SEEK\_SET)

Read

fgetc (FILE\* stream) - 1 char  
fgets ( " ) - line of text from  
fread (store@ptr, size bytes, nitems, ptr)

Write

fputc (FILE\* stream)  
fputs ( " )  
fwrite (from ptr, size bytes, nitems, to ptr)  
fprintf (to ptr, like printf)

SEEK: fseek (file\*, offset, from whence) \*

# LIBRARIES

cctype.h	stdio.h	string.h	stdlib.h	cs50.h	time.h
isupper islower toupper tolower isalpha isdigit	printf sprintf fopen fclose fputc fputs fread fwrite fseek fsetpos ftell sscanf	strlen strcpy strncpy strcmp stricmp strcat strncat	drand48 free malloc realloc srand srand48 atoi atof	GetChar GetInt GetDouble GetString GetLongLong string BOOL StdIn.h uint8_t uint32_t	time math.h round lround

\* adds +0  
string +0  
end of string

\* string → double

srand48 (clong int) some int )  
seeds  
time (NULL)

drand48 ( )

in pset 3 (int) (drand48 \* LIMIT)  
cast to int long int

## RUN TIME: LINKED LISTS

inserting into a sorted singly linked list	$O(n)$	$\Omega(1)$
searching in a sorted singly linked list	$O(n)$	$\Omega(1)$

## SORTS

Bubble — do, while (swaps > 0)

insertion — for, while (prev >= 0 && to\_sort < array[prev])

Selection — nested for loops, min = i (not array[i])

merge = sort (int array[], int start, int end)  
merge (int array[], int<sup>l</sup> L\_beg, int<sup>r</sup> L\_end, int<sup>l</sup> R\_beg, int<sup>r</sup> R\_end)

## MEMORY

text	} program itself
initialized data	} global variables defined w/ values
uninitialized data	} global variables w/o values
heap	} memory allocated dynamically w/ malloc
↓	
↑	
stack	} function's parameters & local variables
environment variables	} special variables like return address & user's username