

Quiz 2

out of 50 points

Print your name on the line below.

Do not turn this page over until told by the staff to do so.

This quiz is “closed-book.” However, you may utilize during the quiz one two-sided page (8.5" × 11") of notes, typed or written, and a pen or pencil, but nothing else.

Scrap paper is included at this document’s end.
Unless otherwise noted, assume that any code herein is in C.

Please circle your section leader’s name.

Abe Passaglia	Katie Fifer graded by Chris Power
Andrew Berry	Katie Fifer graded by Katie Fifer
Andrew Granoff	Kelly Heffner
Anjuli Kannan	Kristen Lovin
Charlotte Eccles	Mike Tucker
Chris Stevens	Paul Govereau
David Haley	Rafael Garcia
David Ramos	Roy Shi
Diana MacLean	Thomas Carriero
Doug Lloyd	Tova Wiener
Emily Parfit	Yao Yu
Josh Schwartz	

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final score out of 50

Multiple Choice.

For each of the following questions or statements, circle the letter (a, b, c, or d) of the one response that best answers the question or completes the statement; you need not explain your answers.

0. (0 points.) What can you do at Zombo.com?

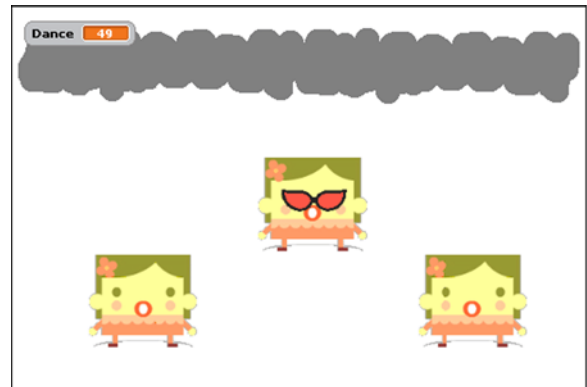
- a. Anything at all.
- b. The only limit is yourself.
- c. The infinite is possible.
- d. The unattainable is unknown.

1. (0 points.) What will you miss most?*

a.



b.



c.



d.



* If you don't recognize (a), we miss you too.

Trees and Tries.

2. (2 points.) Recall that a Huffman-compressed file can actually be larger in size than the original, uncompressed version of that file. Why is that the case?
3. (4 points.) Suppose that Microsoft plans to implement the next version of Word's spell-checker using a hash table with separate chaining. Consider the following hash function (whose documentation explains that it is up to callers to ensure that `word` points to an alphabetical character), the role of which is to decide where in that hash table to insert (or find) some English word.

```
int
hash(char *word)
{
    return (toupper(word[0]) - 'A');
}
```

Critique this hash function by pointing out something good (in one or more sentences) as well as something bad (in one or more sentences) about its design and/or implementation.

4. (2 points.) Suppose that n English words have been inserted into some trie, each of whose nodes contains an array of p pointers to other nodes. In terms of O , how much time is required to look up a word of size k in that trie? Explain your answer in a sentence or more; if your answer depends on any assumptions, state your assumptions.

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Super Smash Bros.

5. (4 points.) Consider the function below.

```
char *  
iBroken(char *input)  
{  
    char *output;  
    for (int i = 0, n = strlen(input); i < n; i++)  
        output[i] = input[i];  
    return output;  
}
```

Point out at least one bug in this function that puts at risk the security of the system executing this function, and then explain why that bug puts the system at risk.

Some More Queries for You.

Suppose that a database of students is implemented with a table called `students` whose structure is depicted below.

Field	Type	Attributes	Null	Default	Extra
<u>id</u>	int(11)	UNSIGNED	No		auto_increment
name	varchar(255)		No		
username	varchar(8)		No		
dorm	varchar(255)		Yes	NULL	

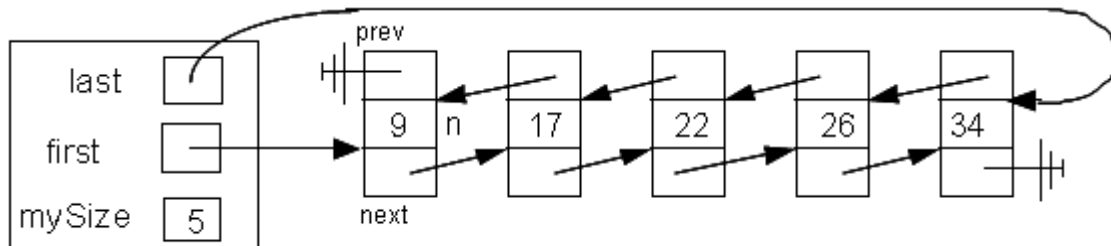
6. (2 points.) Which field(s) could be used as a primary key? Why?
7. (2 points.) With what SQL query could you select all rows representing students known to be living in Matthews?

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Doubly Linked Lists.

Suppose that a doubly linked list for integers is implemented as the below figure from Week 6 suggests, with those integers sorted from smallest to largest.



8. (4 points.) Much like the struct called `Forest` was implemented with the help of a struct called `Plot` for Problem Set 6, so does this figure suggest that a doubly linked list can be implemented with a struct called, say, `List`, with the help of a struct called, say, `Node`.

In the space below, provide definitions for `Node` and `List` consistent with the design implied by the figure.

```
typedef struct Node_t
{
```

```
    }
    Node;
```

```
typedef struct List_t
{
```

```
    }
    List;
```

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9. (6 points.) Complete the implementation of `find`, below, in a manner consistent with your definitions for `Node` and `List`, in such a way that, if `n` is present in `list`, `find` returns `TRUE`, else it returns `FALSE`. Take care to avoid potential segfaults.

```
bool  
find(List *list, int n)  
{
```

Rapid Fire.

For each of the questions below, we expect an answer of no more than three sentences.

10. (2 points.) What's the difference between the `.` (*i.e.*, dot) operator and the `->` operator, with respect to `structs`?
11. (2 points.) What's one difference between source code and object code?
12. (2 points.) With respect to a CPU, what is a register?
13. (2 points.) What's an associative array in the context of PHP?
14. (2 points.) What's one difference between GET and POST in the context of HTTP?
15. (2 points.) What's one advantage of writing some program in PHP instead of C?
16. (2 points.) What's one advantage of writing some program in C instead of PHP?

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Fun with Tables.

17. (6 points.) Complete the table below by providing tight bounds on the amount of time required for insertion of an integer into each of the specified data structures, each of which already contains n other integers.

If any of your bounds depends on some assumption, note your assumption.

	O	Ω	assumptions, if any
insertion into an unsorted singly linked list			
insertion into a sorted singly linked list			
insertion into a heap			

18. (4 points.) Consider the code below.

```
int x = 0xA;
int y = 0x5;
```

Recall that 0xA is 10 in decimal and that 0x5 is just 5 in decimal. Complete the table below by specifying (in binary, decimal, or hexadecimal) the value of each expression, each of which employs a bitwise operator. For simplicity, assume that an int is 8 bits.

$x \ \& \ y$	
$x \ \ y$	
$x \ ^ \ y$	
$\sim x$	

19. That's it for Quiz 2! The course's very last lecture will be two days hence on Friday, 14 December 2007. Come for some learning. Come for some food.

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Extra Credit. “Extra Credit.”

20. (0 points.) Find the following memories in the puzzle down below; each memory can appear in any direction (up, down, left, right, or even diagonally).

BAR, BAZ, BMP, BOSCO, CAESAR, DHELMET, D'OH, FOO, FTW, GCOSTANZA, HAXOR,
HTH, MARIO, MISPELLINGS, MSCOTT, N00B, OMG, PIGGIES, PWNEED, QUX, RTFM,
SCRATCH, SMILEY, TTFN, VIGENERE, WHODUNIT

A	R	V	L	X	U	Z	S	P	J	W	N	I	J	S	E	I	G	G	I	P	T	B	D	V
R	X	G	M	O	L	F	J	C	Z	T	T	I	F	Z	A	O	G	U	Z	L	Z	I	F	M
T	X	U	K	K	P	B	N	Z	N	F	T	I	I	B	A	Z	C	F	W	D	S	K	J	T
F	U	D	O	C	S	L	V	N	J	E	M	U	N	D	E	O	Y	J	Q	B	K	H	H	D
M	M	D	X	L	M	E	W	E	E	X	W	D	R	U	K	A	Z	W	E	W	H	W	Z	O
D	X	O	E	B	Y	T	G	W	Y	O	U	S	O	E	D	D	X	E	X	R	W	J	U	K
M	A	C	C	N	X	T	D	V	C	O	G	Q	W	I	D	O	X	R	A	S	E	A	C	X
L	L	U	W	S	W	Y	L	J	C	Q	P	I	Z	Q	Q	M	H	H	B	W	W	K	N	Q
V	Y	V	D	D	O	P	U	G	R	B	P	P	S	J	C	Q	E	W	R	V	M	R	I	Q
U	E	M	G	I	S	B	V	Z	O	I	G	P	N	R	B	H	Y	X	K	T	F	D	A	X
C	L	F	P	B	R	I	K	X	G	Q	C	V	C	O	J	W	A	R	N	U	H	C	Y	G
U	I	J	S	G	N	I	L	L	E	P	S	I	M	X	K	X	U	D	D	E	T	B	N	S
T	M	B	M	G	C	O	S	T	A	N	Z	A	W	A	Q	Q	O	J	L	T	T	S	J	U
X	S	X	A	F	K	O	E	S	B	L	P	H	O	H	L	K	M	M	I	X	F	Z	W	L
B	D	R	R	X	F	O	O	U	T	B	V	A	M	S	W	C	E	N	I	Z	N	V	R	M
N	F	D	I	J	R	C	H	L	U	A	L	V	G	N	P	T	B	B	X	Q	K	Z	K	M
C	S	O	O	Z	B	V	C	A	V	R	G	D	V	H	G	Y	D	H	M	P	U	S	S	Z
Q	Q	X	H	B	V	W	T	E	O	L	X	N	E	T	G	T	Y	S	E	P	E	C	H	A
Q	F	Q	W	Y	F	X	A	U	Q	E	Z	I	O	P	O	T	U	N	I	R	O	C	C	L
Q	I	H	H	S	C	W	R	W	B	K	S	E	J	X	B	V	V	D	E	T	D	U	X	Q
M	L	L	G	A	P	G	C	W	X	W	O	B	V	E	F	X	X	N	T	D	U	J	X	F
N	B	Q	G	I	O	M	S	E	S	X	I	O	F	L	B	E	E	E	M	D	'	O	H	Z
J	J	M	D	V	Q	E	C	J	F	D	D	O	S	W	A	G	I	H	T	H	V	C	S	U
L	O	U	P	L	S	T	P	F	K	Q	I	N	U	B	I	V	O	A	R	Q	L	P	G	G
H	L	S	Y	J	Y	J	N	B	I	S	Z	C	O	V	W	R	U	R	L	I	I	I	K	J

Extra Credit. “Extra Credit.”

21. (0 points.) Write a program in C or PHP that, when executed (if C) or interpreted (if PHP), prints its own source code, verbatim.

HACKER EDITION

Scrap Paper.

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