

Quiz 1

out of 62 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, nothing else.

Scrap paper is included toward this document's end.

Please circle your section leader's name.

Andrew Selligren

Batool Ali

Dan Nevius

David Robinson

Derek Lietz

Doug Lloyd

Drew Robb

Filip Zembowicz

Jesse Cohen

John Selig

Jon Noronha

Jonathan Yip

Josh Bolduc

Karim Atiyeh + Thomas Prufer

Ken Parreno

Kent Rakip

Lee Evangelakos

Marta Bralic

Matthew Chartier

Michelle Konstadt

Mike Teodorescu

Mike Tucker

Nathan Leiby

Patrick Quinn

Rose Cao

Saba Zaidi

Ted Rogers

Yuhki Yamashita

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final score out of 62

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.) Which is Ken?

a.



b.



c.



d.



1. (1 point.) Which is not a SQL statement?

- a. INSERT
- b. SEARCH
- c. SELECT
- d. UPDATE

2. (1 point.) A hexadecimal digit (whose maximal value is F) generally represents how many bits?

- a. 1
- b. 2
- c. 3
- d. 4

3. (1 point.) An octal digit (whose maximal value is 7) generally represents how many bits?

- a. 1
- b. 2
- c. 3
- d. 4

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True or False.

For each of the statements below, circle T if the statement is true or F if the statement is false.

- 4. T F (0 points.) Scratch is a drag-and-drop programming language.
- 5. T F (1 point.) All .php files must start with a shebang.
- 6. T F (1 point.) valgrind is a compiler.
- 7. T T (0 points.) I went to a Windows 7 launch party but won't admit it.

Sesame Street.¹

- 8. (3 points.) Suppose that Sesame Street's Count is trying to learn binary and needs you to translate zero through seven to binary for him.² Complete the table below, the first of whose rows we've translated for you.



Zero, ah ah ah...	000
One, ah ah ah...	
Two, ah ah ah...	
Three, ah ah ah...	
Four, ah ah ah...	
Five, ah ah ah...	
Six, ah ah ah...	
Seven, ah ah ah...	

- 9. (2 points.) Now help the Count translate forty to both binary and hexadecimal by completing the table below in honor of Sesame Street's 40th birthday.

decimal	binary	hexadecimal
40		

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¹ <http://www.google.com/logos/sesamestreet.html>

² Mature, yes?

Shuttleboy.

10. (4 points.) Like most of CS50's apps, Shuttleboy offers an API whereby you can search for upcoming shuttles via URLs like the below.

```
http://shuttleboy.cs50.net/search?a=Quad&b=Stadium&output=csv
```

For instance, if you happened to request that URL at, say, 5:15pm on Sat 11/14 (when David thought of this question), you'd have gotten back the CSV file below, each of whose rows (after the header row) represents a shuttle that departs from the Quad for the Stadium at or after 5:15pm that day. In other words, the API's output varies based on the day and time at which you issue requests.

```
date,departure_time,arrival_time
2009-11-14,17:15:00,17:32:00
2009-11-14,17:45:00,18:02:00
2009-11-14,18:15:00,18:32:00
2009-11-14,18:45:00,19:02:00
2009-11-14,19:15:00,19:32:00
```

Suppose that some quadlings have asked you to implement in PHP a webpage that outputs an XHTML table that tells them, row by row, when the next shuttles from the Quad to the Stadium are, using Shuttleboy's API to find those next shuttles. Complete the implementation of that webpage below. Assume that the value of `URL` is the URL above. Do not hardcode any dates or times into your webpage; read them dynamically from `$fp`.

```
<!DOCTYPE html
  PUBLIC "-//W3C//DTD XHTML 1.0 Transitional//EN"
  "http://www.w3.org/TR/xhtml1/DTD/xhtml1-transitional.dtd">
<html xmlns="http://www.w3.org/1999/xhtml">
  <head><title>Quiz 1</title></head>
  <body>
    <table>
      <tr>
        <td>Date</td>
        <td>Departure Time</td>
        <td>Arrival Time</td>
      </tr>
      <?
        $fp = fopen(URL, "r");
```

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Sectioning.

For the questions below, consider the following sectioning form:

```
<form action="http://section.cs50.net/section.php" method="get" name="section">
  Name:
  <input name="name" type="text" />
  <br />
  Comfort:
  <input name="comfort" type="radio" value="more" /> More Comfortable
  <input name="comfort" type="radio" value="less" /> Less Comfortable
  <input name="comfort" type="radio" value="between" /> Somewhere in Between
  <br />
  <input type="submit" value="Section" />
</form>
```

11. (1 point.) Suppose that Drew (who's among those less comfortable) sections for CS50 by filling out this form. What URL would Drew see atop his browser upon submitting this form?

12. (2 points.) Suppose that the staff adds

```
onsubmit="return validate();" 
```

to the sectioning form's `form` tag to prevent submission of forms without names.³ Complete the implementation of `validate` below in such a way that it returns `false` if a student has failed to input his or her name, else it returns `true` (whether or not he or she has selected a radio button).

```
function validate()
{
```

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³ Believe us, it happens.

Back to C.

13. (2 points.) Recall that `sizeof` returns the size, in bytes, of a data type. Complete the table below, one of whose rows we've plucked off for you. Assume a 64-bit architecture like `cloud.cs50.net`; do not assume a 32-bit architecture like `nice.fas.harvard.edu`.

<code>sizeof(char)</code>	
<code>sizeof(char *)</code>	
<code>sizeof(int)</code>	4
<code>sizeof(int *)</code>	

14. (4 points.) Consider the program below.

```
#include <cs50.h>
#include <stdio.h>

int
main(int argc, char *argv[])
{
    char *s = GetString();
    printf("hello, %s\n", s);
}
```

Explain in just a few sentences the process by which this source code becomes an executable binary, taking care to use and explain each of these boldfaced verbs (or conjugations thereof) in your story: **preprocess**, **compile**, **assemble**, and **link**.

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Rapid Fire.

Answer the questions below in one or two sentences each.

15. (2 points.) Why implement anything in PHP given that C programs run so much faster?

16. (2 points.) What does it mean to obfuscate code?

17. (2 points.) What's a primary key?

18. (2 points.) What's Ajax?

19. (2 points.) What's an associative array?

20. (2 points.) What does it mean for a machine to be little-endian?

21. (2 points.) What's an API?

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“Valgrind hates me.”

22. (2 points.) Suppose that Alice sees the warning below when she runs her program through Valgrind on `nice.fas.harvard.edu`.

```
Invalid write of size 4
```

Explain what the problem might be and how Alice can fix it.

23. (2 points.) Suppose that Dev sees the warning below when he runs his program through Valgrind on `nice.fas.harvard.edu`.

```
definitely lost: 40 bytes in 1 blocks.
```

Explain what the problem might be and how Dev can fix it.

Er, not really.

For each of the claims below, explain why it’s, er, not really true.

24. (2 points.) “I just learned XHTML. I know how to program.”

25. (2 points.) “You can reduce any file’s size to just one bit by compressing it again and again with Huffman coding.”

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Bitwise.

26. (2 points.) Consider the below implementation of `even`, which is supposed to return `true` if and only if `n` is even.

```
bool
even(int n)
{
    if (n & 0x00000001)
        return false;
    else
        return true;
}
```

If this implementation works as it's supposed to, explain why it works. If this implementation does not work as it's supposed to, explain why it doesn't work and how to fix it.

27. (2 points.) Consider the below implementation of `double`, which is supposed to return twice the value of `n`. (Assume that the value of `n` will be less than $2^{30} - 1$.)

```
int
double(int n)
{
    return n << 1;
}
```

If this implementation works as it's supposed to, explain why it works. If this implementation does not work as it's supposed to, explain why it doesn't work and how to fix it.

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Design Decisions.

For each pair below, x versus y , argue in one sentence when you should use x over y (or, if you prefer, y over x).

28. (2 points.) *MySQL* versus *CSV*

29. (2 points.) *JSON* versus *CSV*

30. (2 points.) *hash table* versus *trie*

31. (2 points.) *POST* versus *GET*

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Binary Trees.

For the questions below, recall that a binary tree is a data structure, each of whose nodes has a value and no more than two children. Assume the below definition for `node`.

```
typedef struct node
{
    int n;
    struct node *left;
    struct node *right;
}
node;
```

32. (2 points.) Consider the function, `foo`, below.

```
bool
foo(node *ptr, int n)
{
    if (ptr == NULL)
        return false;
    else if (ptr->n == n)
        return true;
    else if (foo(ptr->left, n))
        return true;
    else if (foo(ptr->right, n))
        return true;
    else
        return false;
}
```

Propose a more descriptive name for this function than `foo`. And explain what the function (formerly called `foo`) does.

33. (3 points.) Suppose that each node in a binary tree has been allocated with `malloc` and that `unload`, when passed the root of a tree, is supposed to free each of its nodes, including the root. Complete the implementation of `unload` below.

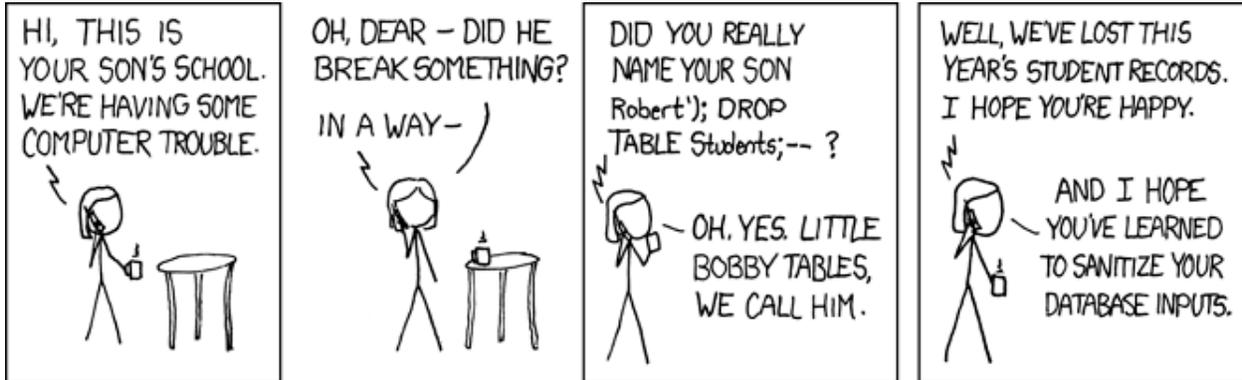
```
void unload(node *ptr)
{
```

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Scrap Paper.

Nothing on this page will be examined by the staff (except this comic, because it's funny) unless otherwise directed in the space provided for some question.



<http://xkcd.com/327/>

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