**University of California, Berkeley – College of Engineering**
Department of Electrical Engineering and Computer Sciences
Spring 2011 Instructor: Dan Garcia 2011-03-31

# CS10 Paper Midterm

| | |
|---|---|
| *Last Name* | |
| *First Name* | |
| *Student ID Number* | |
| `cs10-` *Login First Letter* | **a b c d e f g h i j k l m** |
| `cs10-` *Login Last Letter* | **a b c d e f g h i j k l m**<br>**n o p q r s t u v w x y z** |
| *The name of your LAB TA (please circle)* | **Glenn Luke Navin** |
| *Name of the person to your Left* | |
| *Name of the person to your Right* | |
| *All my work is my own. I had no prior knowledge of the exam contents nor will I share the contents with others in CS10 who have not taken it yet.* ***(please sign)*** | |

## Instructions

- Don't Panic!
- This booklet contains 6 pages including this cover page. Put all answers on these pages; don't hand in any stray pieces of paper.
- Please turn off all pagers, cell phones and beepers. Remove all hats and headphones.
- You have 110 minutes to complete this exam. The midterm is closed book, no computers, no PDAs, no cell phones, no calculators, but you are allowed two double-sided sets of notes. There may be partial credit for incomplete answers; write as much of the solution as you can. When we provide a blank, please fit your answer within the space provided.

| **Question** | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | **11** | **12** | **13** | **Online** | **Total** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Points** | **2** | **2** | **2** | **2** | **2** | **2** | **2** | **2** | **2** | **6** | **6** | **10** | **10** | **10** | **60** |
| **Score** | | | | | | | | | | | | | | | |

# Short-answer Questions

**Question 1** : Here's a friend's position: *"The young people of today of today use computers all the time. They are 'digital natives', comfortable with sending text messages, playing online games, browsing the web, and interacting with digital media. They have achieved 'digital fluency' "*. In one sentence, respond to this as if you were one of the authors of Scratch.

**Question 2:** Multicore computers shift the burden of software performance from chip designers and processor architects to _____.

**Question 3:** GWAPs serve multiple purposes. The real measure of utility of a GWAP is both _____ and _____.

**Question 4:** "Theory" and "experimentation" were known, for years, as the twin pillars of science. What is the third pillar of science that Prof Yelick demonstrated? _____

**Question 5:** The personal computer, laserwriter, graphic design software and the Postscript language combined to be remarkably democratizing, putting professional-quality print output (once reserved to pros in print houses) in the hands of the masses. Name another important democratizing technology (aside from those mentioned here), and who used to hold the power.

**Question 6:** How would you best respond to your friend who says: "What's the big fuss Raffi Krikorian from Twitter was making about his engineering team's challenges? Sheesh! Tweets are only 140 characters … how hard can it be to send these around?"

**Question 7:** Your non-technical friend asks how it's possible that a generic search engine "Jen" can search the entire web and have an answer in a split-second, even though when they visit their OWN website it takes 5 seconds to load. How does Jen do it so fast?

**Question 8:** Your friend says: *"I host a few thousand illegally-downloaded songs on my server so others can listen to it. I'm not worried, how would anyone be able to find me, since there are so many others like me doing the same thing?".* Respond with some facts from *Blown to Bits*.

**Question 9**: One of the things we've talked about in this class a fair bit is the unexpected consequences of technology. In 2001, Dean Kamen touted his Segway self-balancing electric vehicle (shown on the right, perhaps you've seen these around campus) as a personal transporter that would revolutionize transportation, especially in cities. If the general public widely adopted the technology, what do you believe is *the worst possible negative consequence*?

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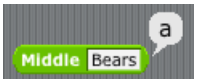
## Question 10: *Beethoven wasn't the only great composer…*

We've provided some helper reporter blocks that work on *both* words and sentences.

| Block | Description | Word example | Sentence example |
|---|---|---|---|
| `Middle` | Report the middle item of a word / sentence |   |   |
| `Unend` | Remove the ends of a word / sentence. |   |   |
| `Triple` | Triplicate a word / sentence |   |   |
| `Right` | Rotate a word / sentence to the right |   |   |
| `Left` | Rotate a word/sentence to the left |   |   |

Fill in the blanks below with only calls to the reporter blocks above: `Middle`, `Unend`, `Triple`, `Right` and `Left` so that the expressions evaluate correctly. Use the techniques from "Writing Scratch/BYOB code on paper". E.g.,  would be written `Right(Triple(Bears))`



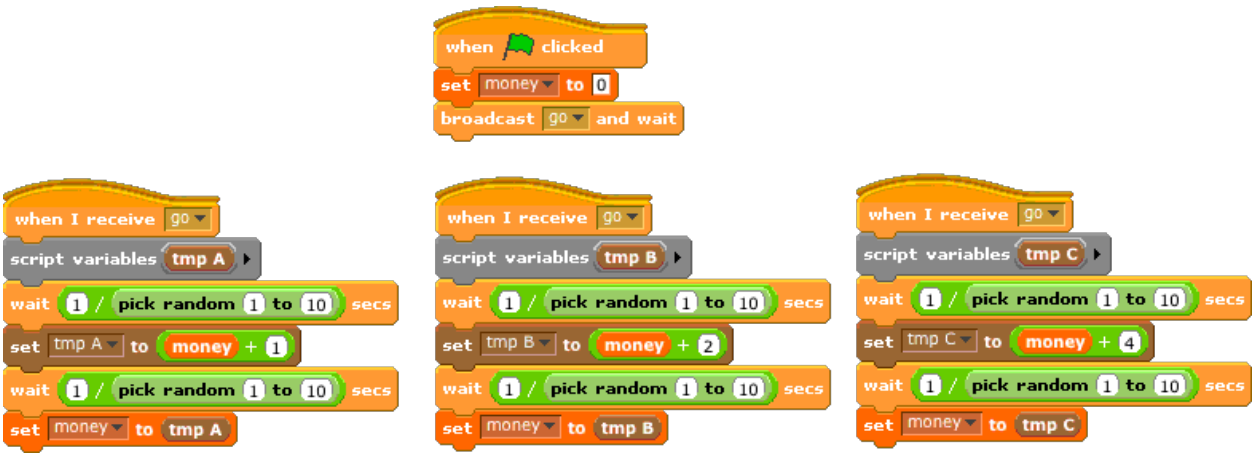
a) _____`(Go Bears and Beat Stanford)`___ ➔ `ear`

b) _____`(ihigh)`____ ➔ `highigh`

*…you may use at most 5 reporter blocks for your answer to part (b)…*

## Question 11: *So there were these three brothers…*

Three brothers (A, B and C) go off into the world to earn money for the family, and earn 1, 2, and 4 dollars respectively. Their parents want to find out how much money the family now has (they start with $0), so they put a scrap of paper on the kitchen table that reads $0 and go up to bed. Each brother (when he returns home) is to add his amount to the amount on the paper and write the new sum on the paper. The problem is these brothers are bad at math and need to do the addition on a temporary scratch paper. The brothers take a random amount of time to copy the current amount onto their scratch paper and another random amount of time to do the math before copying the sum back over. We've tried to simulate this situation with code below:




a) What is the name we give to this type of situation? _____

b) What are ALL the possible final values of money on the scrap of paper? _____

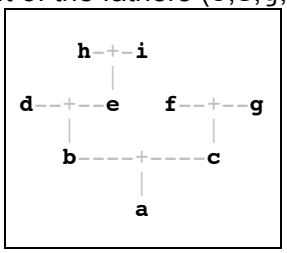
Login: `cs10-____`

## Question 12: *Respect the family…*

You are interested in finding the *number of a person's ancestors*, that is, them, their parents, their parents' parents, etc. In their family, everyone has a unique name and couples are always recorded together -- if you find one parent, you've found the other. You are provided with three helper blocks (which access some global family tree): parents found? person, mother person and father person. All three take as input a single argument, a person (however that is represented):

- parents found? person reports true or false depending on whether the system has found that person's parents (mother *and* father) or not.
- mother person reports that person's mother (a person), if she was found. (If she wasn't found, it's an error)
- father person reports that person's father (a person), if he was found. (If he wasn't found, it's an error)

Example family: In the diagram, mothers (`b`,`d`,`f`,`h`) are listed to the left of the fathers (`c`,`e`,`g`,`i`)
`a`'s parents were found, `b` and `c`. (`b` is the mother, `c` is thefather)
`b`'s parents were found, `d` and `e`.
`c`'s parents were found, `f` and `g`.
`e`'s parents were found, `h` and `i`.
`d`, `f`, `g`, `h` and `i`'s parents were not found in the family tree.




Examples:
parents found? e reports true, because we found `e`'s parents, who are `h` and `i`.
parents found? d reports false, because we didn't find `d`'s parents.
mother e reports `h`, because `e`'s mother is `h`. (calling mother on `d`, `f`, `g`, `h` or `i` is an error)
father e reports `i`, because `e`'s father is `i`. (calling father on `d`, `f`, `g`, `h` or `i` is an error)

Fill in the blanks for the block ancestors person that reports that person's **total number** of their ancestors (counting themselves). Examples:

ancestors a reports 9 (for `a b c d e f g h i`)
ancestors b reports 5 (for `b d e h i`)
ancestors c reports 3 (for `c f g`)
ancestors d reports 1 (for `d`), etc...

```
ancestors(PERSON)
    if ( ____________________________________ )
        report ( ____________________________________________________ )
    else
        report ( ____________________________________________________ )
```

## Question 13: *Dyslexics of the world untie!* `abcdefghijklmnopqrstuvwxyz`

You have a friend Betty who speaks in a very curious way. Every word she says has all its *letters* always *non-decreasing from a to z*. For example, she recently said while on a trip (we've removed the punctuation in our transcription):

`"hi bill now i am lost"`

Every word has the letters progress forward from a to z, never moving backward. Sometimes there are repeated letters (as in `bill`), but they're ok because they're still non-decreasing.

You are interested in writing the predicate Betty? to determine if a particular word is a word Betty would speak. Here is the code we've written; unfortunately it may have a bug or two. We're showing two identical versions of the code, BYOB and BYOB-as-text:


```
  Betty?(WORD)

     script-variable(ANSWER)

1    set(ANSWER)to(true)

2    repeat-until( length-of(WORD) < 2 )

3        if( not( letter(1)of(WORD) < letter(2)of(WORD) ) )

4            set(ANSWER)to(false)

5        set(WORD)to(all-but-1st-letter-of(all-but-1st-letter-of(WORD)))

6    report( ANSWER )
```

a) The order of growth of `Betty?` as a function of the length of `WORD` is _____.

b) The first bug is that Betty? should return true for all the words in Betty's remark above, but it doesn't. Complete the sentence below for 1 of those words and fix it.

`Betty?(`_____`)` returns false instead of true, but changing line _____ to

_____ solves that.

c) Let's say you make the fix in (b) correctly; there's one remaining bug. Complete the sentence: The smallest input that should return false but instead returns true is

_____; changing line ___ to _____ fixes it.