

**CIS 110 — Introduction to Computer Programming  
Summer 2016 — Midterm**

Name: \_\_\_\_\_

Recitation # (e.g., 201): \_\_\_\_\_

Pennkey (e.g., paulmcb): \_\_\_\_\_

My signature below certifies that I have complied with the University of Pennsylvania's Code of Academic Integrity in completing this examination.

\_\_\_\_\_  
Signature

\_\_\_\_\_  
Date

**Instructions:**

- **Do not open this exam until told by the proctor.**  
You will have exactly 60 minutes to finish it.
- **Make sure your phone is turned OFF (not to vibrate!) before the exam starts.**
- Food, gum, and drink are strictly forbidden.
- **You may not use your phone or open your bag for any reason**, including to retrieve or put away pens or pencils, until you have left the exam room.
- This exam is *closed-book, closed-notes, and closed-computational devices*.
- If you get stuck on a problem, it may be to your benefit to move on to another question and come back later.
- All code must be written out in proper java format, including all curly braces and semicolons.
- Do not separate the pages. If a page becomes loose, - re attach it with the provided staplers.
- Staple all scratch paper to your exam. Do not take any sheets of paper with you.
- If you require extra paper, please use the backs of the exam pages or the extra pages provided at the end of the exam. **Clearly indicate on the question page where the graders can find the remainder of your work (e.g., "back of page" or "on extra sheet").**
- Use a pencil, or blue or black pen to complete the exam.
- If you have any questions, raise your hand and a proctor will come to answer them.
- When you turn in your exam, you may be required to show ID. **If you forgot to bring your ID, talk to an exam proctor immediately.**
- We wish you the best of luck.

**Scores:** [For instructor use only]

Question 1		9 pts
Question 2		12 pts
Question 3		10 pts
Question 4		9 pts
Question 5		15 pts
<b>Total:</b>		<b>55 pts</b>

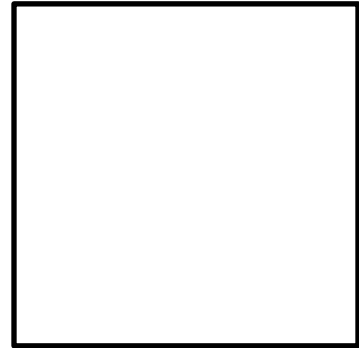
**1.) MISCELLANEOUS (9 pts total)****1.1) (1 point)** The Easy One:

- Check that your exam has all **10** pages (excluding the cover sheet).
- Write your name, recitation number, and PennKey (username) on the front of the exam.
- Sign the certification that you comply with the Penn Academic Integrity Code.

**1.2) (2 points)** In the space provided, draw what the result of running the following code fragment in PennDraw would be:

```
PennDraw.drawRectangle(.5, .25, .5, .25);  
PennDraw.drawLine(1.5, .5, 1.0, 1.0);
```

Note: color doesn't matter. Use any writing utensil

**1.3) (2 points)** How many times would this code fragment print the text “Hello World”?

```
for (int i = 11/2; i >= 0; i -= 5;) {  
    System.out.println("Hello World");  
}
```

- A. Zero (0)
- B. One (1)
- C. Two (2)
- D. None, this is invalid Java code

**1.5) (2 points)** `int x = 3+(int)(3.99)*2;`

What does x equal after this statement?

- A. Nine (9)
- B. Eleven (11)
- C. Twelve (12)
- D. Fourteen (14)

**1.4) (2 points)** The result of evaluating

$$4 / 3 + 5 * 2 / 3 = \underline{\hspace{2cm}}$$

## 2.) OPERATORS AND EXPRESSIONS (12 points total)

For each code fragment, (a) fill in the most appropriate data type in the 1st column and (b) give the value that z contains after the code has been executed in the 2nd column.

If the code would result in an error, write “ERROR” in the 1st column and give the reason for the error in the 2nd column (you do not need to write the exact error message, just a general explanation). The first two problems have been completed for you.

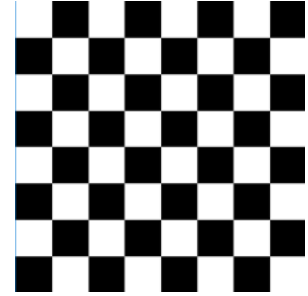
<code>_____ z = 11; z++;</code>	int	12
<code>int x = "Hello World"; _____ z = x.length;</code>	ERROR	Int X cannot be set to a string
<code>int x = 5; int y = 3; _____ z = x / y * 2.0;</code>		
<code>char a = 97; _____ z = a++;</code>		
<code>int[] x = { 2, 1, 3, 0 }; _____ z = x; x[x[0]++]++;</code>		
<code>_____ z = 5.5; z %= 4.0;</code>		
<code>_____ z == true;</code>		
<code>String str = "Midterm";</code>		

_____ z = str + 5;		
--------------------	--	--

### 3.) CONDITIONALS AND LOOPS (10 points total)

The code fragment below contains four blanks, labeled A, B, C, D, and E. Fill in the blanks to make the chessboard image shown on the right. Note that it must match the image as much as possible. Pay special attention to the corner tiles:

```
for(_____ A _____){
    for(_____ B _____){
        if ((i+j)%2 _____ C _____ 0){
            PennDraw.setPenColor(PennDraw.BLACK);
        }
        else{
            PennDraw.setPenColor(PennDraw.WHITE);
        }
        double xCenter = _____ D _____ ;
        double yCenter = _____ E _____ ;
        PennDraw.filledRectangle(xCenter, yCenter, 0.5/8, 0.5/8);
    }
}
```



Blank A: \_\_\_\_\_

Blank B: \_\_\_\_\_

Blank C: \_\_\_\_\_

Blank D: \_\_\_\_\_

Blank E: \_\_\_\_\_

You may use the space below for notes

**4) Tracing a Loop (9 points)**

Consider the follow code fragment that contains a nested loop. Use this code fragment to answer the following questions. The next page is blank and may be used for notes.

```
int[] x = {0,0,0,0,0,0,0,0};
for (int i=1; i<x.length; i*=2){ //outer loop
    for (int j=i; j<x.length; j++){ //inner loop
        x[i]++;
        x[j]++;
    }

    //Print array
    for(int j=0; j<x.length; j++){
        System.out.print(x[j]+",");
    }
    System.out.println();
}
System.out.println("exit");
```

How many times will the outer loop execute? \_\_\_\_\_

Write what will be printed line by line from this code fragment. Remember that “System.out.println( );” prints a line break, meaning the next piece of text will appear on the next line.

[line1] \_\_\_\_\_

[line2] \_\_\_\_\_

[line3] \_\_\_\_\_

[line4] \_\_\_\_\_

[line5] \_\_\_\_\_

[line6] \_\_\_\_\_

[line7] \_\_\_\_\_

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**5.) 2D Arrays + Testing (15 points)**

You are tasked with writing a function using test driven development that transposes a matrix, represented as a 2D integer array. An example of transposing a matrix is below:

$$A = \begin{pmatrix} 1 & 2 \\ 3 & 4 \\ 5 & 6 \end{pmatrix} \quad A^T = \begin{pmatrix} 1 & 3 & 5 \\ 2 & 4 & 6 \end{pmatrix}$$

Your function should return a new 2D integer array, without doing anything that changes the values of the original input array. Your function should check the following:

- 1) That the input array isn't empty.
- 2) That every row in the input array has the same number of columns

If either of these conditions fail, then you should print an error and return an empty array.

**5.1) Method declaration (2 points)**

Write the method declaration here. Circle the parts of the method declaration that make up the *method signature*:

---

**5.2) Tests (3 points)**

Write simple tests with the goal of testing both a normal execution, and abnormal execution below. Do not just copy the example above. Your goal is to have coverage as discussed in class. You may write your input and output matrices as they are in the picture above. **You do not have to write them as they would appear in Java.**

If you need more space, use the blank page AFTER 6.3 (page 8)

**5.3) (10 points) Write the code of the function on this page. You may use the next blank page as needed.**

DO NOT PRINT the new array. Rather your function should return the array.



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