Statement of integrity: I did not, and will not, break the rules of academic integrity on this exam:

(Signature)

Circle Your Section:

<table>
<thead>
<tr>
<th></th>
<th>Tuesday</th>
<th>Wednesday</th>
<th>Thursday</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>PH 219</td>
<td>HO 401</td>
<td>HO 306</td>
</tr>
<tr>
<td>1:25</td>
<td>1 Holland-Minkley</td>
<td>2 Yan</td>
<td>11 Artemov</td>
</tr>
<tr>
<td>2:30</td>
<td>3 Holland-Minkley</td>
<td>5 Yan</td>
<td>8 Artemov</td>
</tr>
<tr>
<td>3:35</td>
<td>4 Yan</td>
<td></td>
<td>9 Artemov</td>
</tr>
</tbody>
</table>

Instructions:

- Read all instructions carefully!
- This test is closed book – no calculators, reference sheets, or any other material allowed.
- Initial or sign each page.
- Conciseness, clarity, and style all count. Show all work and comment code fragments to receive partial credit.
- Arrays are not allowed.
- For loops, you must use while. Do not use do-while and for loops.
- You may not alter the structures surrounding blanks and boxes.
- Use the backs of pages if you need more space or scrap. Ask a proctor if you need additional sheets.

Core Points:

1. ________ (30 points) ________

2. ________ (20 points) ________

3. ________ (50 points) ________

Total: ________ / (100 points) ________

Bonus Points: ________ / (10 points) ________
Problem 1  [30 points] Definite Iteration & Arithmetic

Assume you are modeling a collection of molecules with speeds measured in meters per second (m/s). Two measures of average speed for the collection are the mean speed \( v_{\text{mean}} \) and the root-mean-square (rms) speed \( v_{\text{rms}} \):

\[
v_{\text{mean}} = \frac{\text{sum of each speed}}{\text{number of molecules}} \quad \text{and} \quad v_{\text{rms}} = \sqrt{\frac{\text{sum of each speed squared}}{\text{number of molecules}}}
\]

For example, the mean and rms speeds of 1 m/s and 3 m/s are \( v_{\text{mean}} = \frac{1 + 3}{2} = 2 \) and \( v_{\text{rms}} = \sqrt{\frac{1^2 + 3^2}{2}} = \sqrt{5} \).

Fill in the blanks below to write a program to:

- Read the integer number \( n \) of molecules. Assume \( n \) is non-negative.
- Read \( n \) floating-point speeds of molecules. Assume each speed is non-negative.
- Note: The program reads input without printing prompts.
- Print the magnitude of the percent error of \( v_{\text{rms}} \) (“estimated”) from \( v_{\text{mean}} \) (“actual”).

Hints: You might need `Math.sqrt` (square root), `Math.pow`, or `Math.abs`.

```java
public class problem1 {
    public static void main(String[] args) {
        TokenReader in = new TokenReader(System.in);
        int n = ______________________________; // # of molecules
        double sum = _________________________; // sum of speeds so far
        double squares = _____________________; // sum of squared speeds so far
        int k = ______________________________; // # of speeds already processed
        double speed; // speed of a molecule
        // Compute sum of speeds and sum of squared speeds
        while( _________________________ ) {
            ______________________________; // Read next speed
            ______________________________; // Sum speeds
            ______________________________; // Sum squared speeds
            ______________________________; // Increment # of speeds processed
        }
        // Report if zero molecules, or report percent error of Vrms from Vmean
        if ( ________________ )
            System.out.println("No molecules!");
        else {
            double Vmean = ________________________________; // mean speed
            double Vrms = ________________________________; // rms speed
            System.out.println("Percent error: " +
                                ________________________________);
        }
    }
}
```
Problem 2  [20 points] Conditionals & Boolean Expressions

Write a program to compute the number of days in any given month of a non-leap year. Fill in the box below to assign the length in days of month to variable days. Assume month is between 1 and 12, inclusive.

The indices and lengths in an non-leap year of months are:

<table>
<thead>
<tr>
<th>index</th>
<th>Jan</th>
<th>Feb</th>
<th>Mar</th>
<th>Apr</th>
<th>May</th>
<th>Jun</th>
<th>Jul</th>
<th>Aug</th>
<th>Sep</th>
<th>Oct</th>
<th>Nov</th>
<th>Dec</th>
</tr>
</thead>
<tbody>
<tr>
<td>length</td>
<td>31</td>
<td>28</td>
<td>31</td>
<td>30</td>
<td>31</td>
<td>30</td>
<td>31</td>
<td>31</td>
<td>30</td>
<td>31</td>
<td>30</td>
<td>31</td>
</tr>
</tbody>
</table>

Use the following rules to write the program:
Rule 1: Even-index months from Jan to Jul and odd-index months from Aug to Dec have 30 days.
Rule 2: Rule 1 does not apply to Feb.
Rule 3: When Rules 1 and 2 do not apply, the month has 31 days.
For full credit, use concise code to test whether the month index is even or odd.

```java
public class problem2 {
    public static void main(String[] args) {
        TokenReader in = new TokenReader(System.in);
        int month = in.readInt(); // month index: assume from 1 to 12
        int days; // # of days in month
    }
}
```
Problem 3  [50 points] Indefinite Iteration: Processing an input sequence with a stopping value

Fill in the box below to write a program to:

• Read a sequence of integers between -10 and 10, inclusive. An out-of-bounds integer terminates the sequence. You do not need to prompt the user before the input.
• Account for boundary conditions – you might want to do this part last since it might be tricky.
• Declare named constants when appropriate.
• Print the largest pair-sum. A pair-sum is the sum of a pair of neighboring elements.

ex.) The input \(-1\ 10\ 3\ 0\ 11\) has pair-sums \(-1 + 10\), \(10 + 3\), and \(3 + 0\). The largest is 13.

```java
public class problem3 {
    public static void main(String[] args) {
        TokenReader in = new TokenReader(System.in);
    }
}
```
**Bonus:** [10 Bonus Points] CS100 Website & Newsgroup

Bonus Questions:
- Do NOT work on these until you completely finish all core problems. Core determines your grade!!!
- Multiple choice. Circle the correct answer.
- You get +1/0/-1 bonus points for correct, blank, and wrong answers, respectively. Your lowest total bonus grade on this Prelim cannot drop below zero, though.

**B1)** Is 0 a multiple of 17?
   - a) yes  
   - b) no  
   - c) the question makes no sense

**B2)** What sign does 0 have?
   - a) negative  
   - b) positive  
   - c) both  
   - d) neither

**B3)** What is the median of 2, 2, and 5?
   - a) 2  
   - b) 3  
   - c) 4  
   - d) 5  
   - e) there is no median  
   - f) none of these

**B4)** Should you read newsgroups with mono-spaced/fixed-width/non-proportional fonts?
   - a) yes  
   - b) no  
   - c) doesn’t matter

**B5)** Is it OK to put a comment for a group of statements off-to-the-side?
   - a) always OK  
   - b) only OK with proper indentation  
   - c) never OK

**B6)** Can a variable name include the dollar symbol $?
   - a) Java does, but we don’t  
   - b) Java does, and so do we  
   - c) Java does not, and neither do we  
   - d) Java does not, but we do

**B7)** What CS100 programming assignments are partners allowed for?
   - a) only exercises  
   - b) only projects  
   - c) both  
   - d) neither

**B8)** Which letter is NOT a middle initial of Dave S., Thomas Y., Sergei A., Laurie B., or Amanda H.?
   - I)  
   - J)  
   - K)  
   - L)  
   - M)  
   - N)

**B9)** Which of the following people is not on the CS100 staff this semester? (circle one)
   - a) Woong Yoon  
   - b) Daisy Fan  
   - c) Eric Hsieh  
   - d) David Welte  
   - e) Andrew Lee  
   - f) Yi Qun Liu  
   - g) Po Chen  
   - h) Prashanth Hande  
   - i) Raju Rohde

**B10)** Which weekday has the least total time allocated to office hours and tutoring?
   - a) Mon  
   - b) Tue  
   - c) Wed  
   - d) Thu  
   - e) Fri