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>12:20</td>
<td>1 Holland-Minkley</td>
<td>13 Yan</td>
<td></td>
</tr>
<tr>
<td>1:25</td>
<td>2 Yan</td>
<td>6 Holland-Minkley</td>
<td>7 Rohde 10 Fan</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 Fan</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 $v_{mean}$ and the root-mean-square (rms) speed $v_{rms}$:

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

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

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 $v_{rms}$ ("estimated") from $v_{mean}$ ("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>month: Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec</th>
</tr>
</thead>
<tbody>
<tr>
<td>index: 1 2 3 4 5 6 7 8 9 10 11 12</td>
</tr>
<tr>
<td>length: 31 28 31 30 31 30 31 31 30 31 30 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
        // Your code here
    }
}
```
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 9 = \(-1 + 10\), 13 = 10 + 3, and 3 = 3 + 0. The largest is 13.

```java
public class problem3 {
    public static void main(String[] args) {
        TokenReader in = new TokenReader(System.in);
        // Your code here
    }
}
```
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.?

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