CS125 Section 4 SOLUTION

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Partner up! Solve the following in teams of two.
If you get get stuck you may briefly 'raid' another pair to ask for hints!

Challenge 1. For my two state machine, I used a boolean... (15mins)

1.1 Make sure you understand every line in the following program, then pick a better name for the 'flag' variable by working out the algorithm's intended purpose. – ***switch***

ALGORITHM A

```
1 boolean flag = true;
2 int n = 0;
3 while(n != -1) {
4   n = TextIO.getlnInt();
5   if(n == 0) flag = ! flag;
6   if(flag) TextIO.put(n);
7 }
```

1.2 What *exactly* will the code print out if the user enters the following numbers (one per line),

i) 1 0 2 3 0 4 -1 ? ***1 0 4 -1*** ii) 0 0 0 5 0 -1 ? ***0 0 -1***

1.3 What exactly will this code print if lines 4 and 6 above were swapped to create the new version:

ALGORITHM B

```
1 boolean flag = true;
2 int n = 0;
3 while(n != -1) {
4   if(flag) TextIO.put(n);
5   if(n == 0) flag = ! flag;
6   n = TextIO.getlnInt();
7 }
```

for user input i) 1 0 2 3 0 4 -1 ? ***0 2 3 0*** ii) 0 0 0 6 5 0 -1 ? ***0 0 6 5 0***

Challenge 2. Reverse Data Game (5-10 mins)

Carefully read the code below and discuss it with a partner. Your roommate runs the program and secretly enters four numbers (each time entering an integer between 1 and 99).

2.1 For each game the output is shown; what might your friend entered to produce that output?

```
int previous = 0;
int remain = 4;
int value = 0;
int a = 0;
int b = 0;
while (remain > 0) {
   previous = value;
   value = TextIO.getlnInt();
   if (value > previous)
      a= a+1;
   if (value < previous)
      b= b+1;
   remain--;
}
TextIO.put(a);
TextIO.put(',');
TextIO.put(b);
```

```
(Game 0) Example Output: "4,0"
Example input: 10,20,30,40

Game 1 Output: "3,0"
Input?
10,10,20,30

Game 2 Output: "2,2"
Input?
30,20,10,20


Game 3 Output: "1,2"
Input?
30,20,10,10
```

Your friend tells you that the final value of 'a' is suppose to be the number of times the next number was larger than the previous value entered. But the above program is incorrect - the count is "off-by one". Your friend fixes the program. Now the output of Game 0 is "3,0".

2.2 How many different ways might she/he have fixed the program so that the count is correct - (assume input values are always between 1 and 99). Find at least **four** alternate ways your friend might have changed the program to make the count correct.

a)
```
02) int remain = 3;
03) int value = TextIO.getlnInt();
```

b)
```
04) int a = -1;
```

c)
```
15) TextIO.put(a-1);
```

d)
```
09) if (value > previous && remain < 4)
```

e)
```
09) if (value > previous && remain != 4)
```

f)
```
09) if (value > previous && previous != 0)
```

g)
```
09) if (value > previous && previous > 0)
```

Challenge 3. Writing Algorithms (in pairs; 10 mins)

Imagine that you were in charge of a factory that produces Russian nesting dolls (as shown at the right). Your job is to figure out for each design, how many dolls can nest, and how big each one should be.

Assume that each doll has to be 20% smaller than the one it fits in, and dolls smaller than 1" big cannot have dolls nested inside them. Given the size of the outermost doll, we want an algorithm that prints the sizes of each doll followed by the position of the doll from the outermost doll.

3.1 Figure out what order the following lines of pseudo code should be in to provide that algorithm. *Hint: you may need to use some lines more than once. Finished? Let another pair search carefully for error in your algorithm while you check someone else's code!*

```
d) count = 0
f) height = get_Input()
a) count = count + 1
g) while (height >= 1.0)
i) {
h) print height
c) print count
e) height = height * 0.8
a) count = count + 1
b) }
h) print height
c) print count
```

CS125 Section 4 SOLUTION

Challenge 4. Variables and Expressions (5 mins; check your answers using the lab)

4.1 For the uncompleted lines of code state what the problem is with each code fragment.

a) `double x = .07 + 1;` — OK *(1 is promoted to a double)*

b) `char c = 'foo';` — *1 character only.*
```
char c = 'f';
```

c)
```
int y;
y = -47;
```
— OK

d) `int class = 4;` — *class is a reserved word.*

e) `char key_press = 'f';` — OK

f)
```
double lnum;
-107.0 = lnum;
```
— *LHS must be assignable i.e. a variable.*
```
lnum = -107.0;
```

g) `int 1st_value = 100;` — *variable names must start with a letter 'a-z'.*
```
int n1st_value = 100;
```

h) `int size = 3.9;` — *Type Error. Can't assign a double value to an integer.*
```
int size = (int)3.9;
```

i) `char my character = 's';` — *no spaces in variable names.*
```
char my_character = 's';
```

j)
```
diameter = 5.7;
double diameter;
```
— *assignment before declaration.*
```
double diameter;
diameter = 5.7;
```

k) `int v1 = 7, v2 = 8;` — OK

l)
```
int m = 200;
int n = 2*m;
```
— OK

m)
```
int offset = 123;
char c = 'a' + offset;
```
— *Type Error. Can't implicitly convert integer to a char.*
```
char c = (char)('a' + offset);
```

n) `double length = 78493461238;` — *Literal too large to be an integer.*
```
double length = 78493461238L;
```