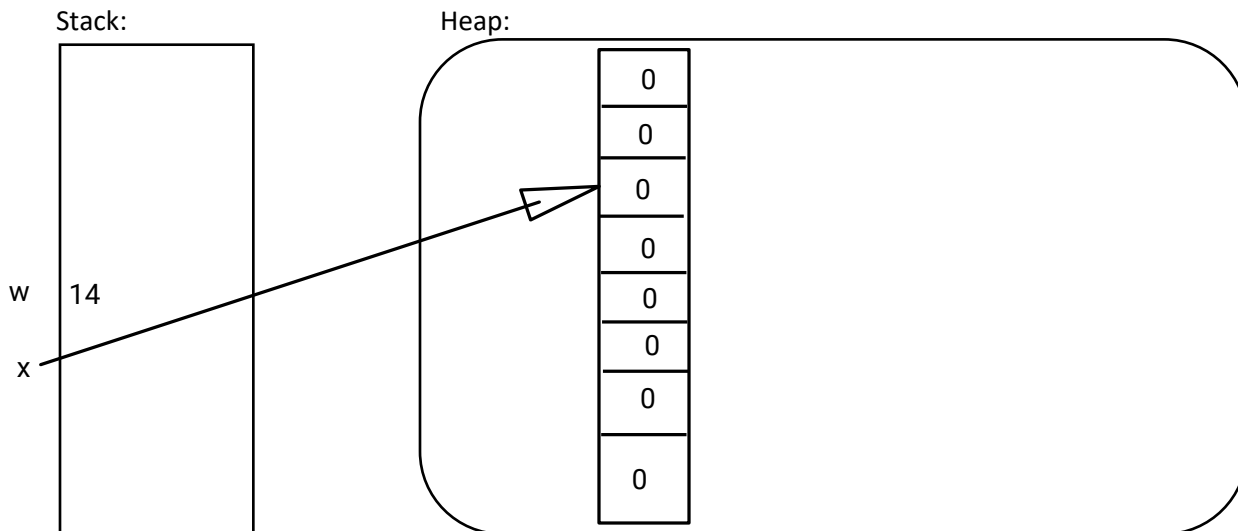Miles Levine
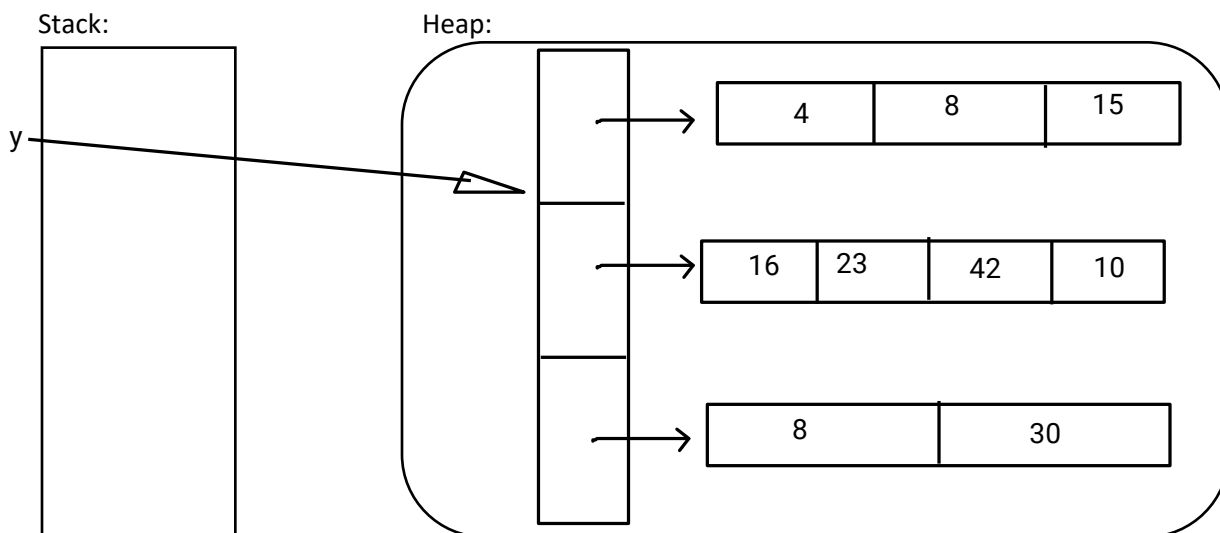Professor Grinberg
3/26/2022
CMSC203

CMSC 203 Lab 5
Memory Mapping

1. Draw the memory map of the following variable int w and one-dimensional array of type int.
   int w = 14;
   int [] x = new int [8];

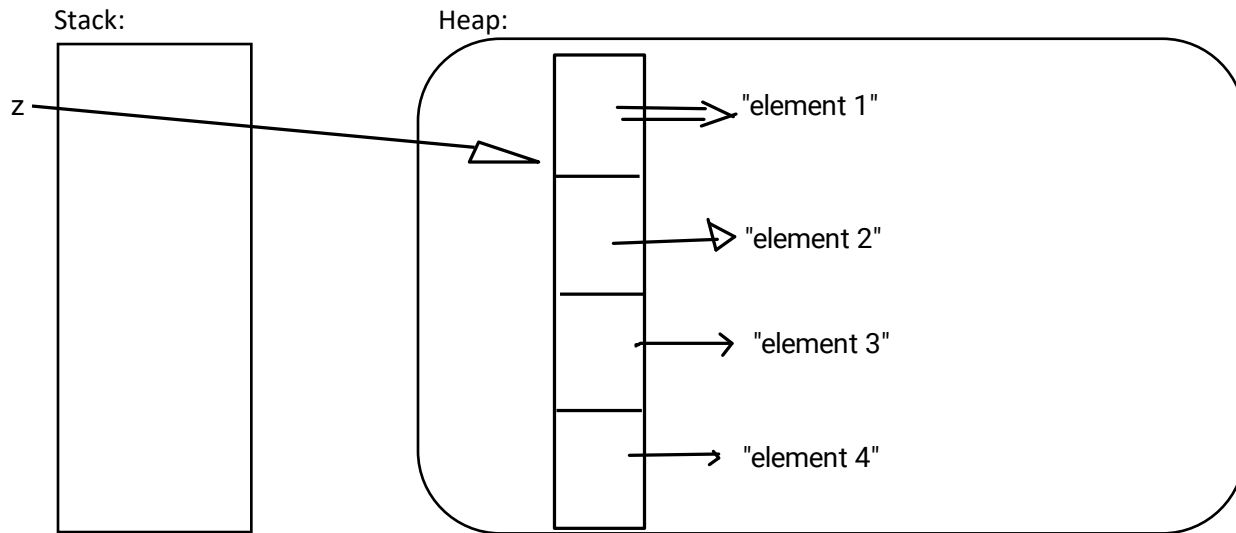Stack: Heap:

w   14

x

2. Draw the memory map of the following two-dimensional ragged array of ints.

   int[][] y = {{4, 8, 15}, {16, 23, 42, 10}, {8, 30}};

Stack: Heap:

y

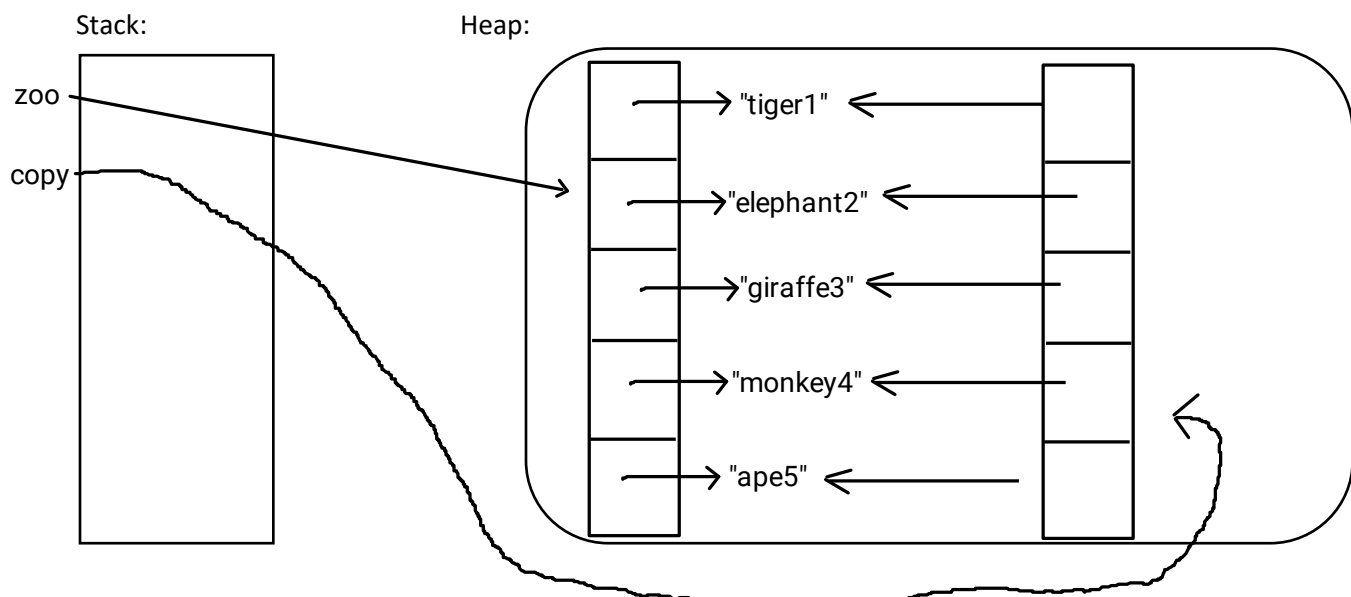3. Draw the memory map of the following one-dimensional array of type String.

```
String[] z = new String[4];
for (int i = 0; i < z.length; i++) {
    z[i] = "element " + i;
}
```

Stack: Heap:

z →   "element 1"

                                   "element 2"

                                   "element 3"

                                   "element 4"

4. a. Write a shallow copy of the following in code. (Assume the five animal objects are already instantiated.)

```
Animal[] zoo = {tiger1, elephant2, giraffe3, monkey4, ape5};
Animal[] copy;
```
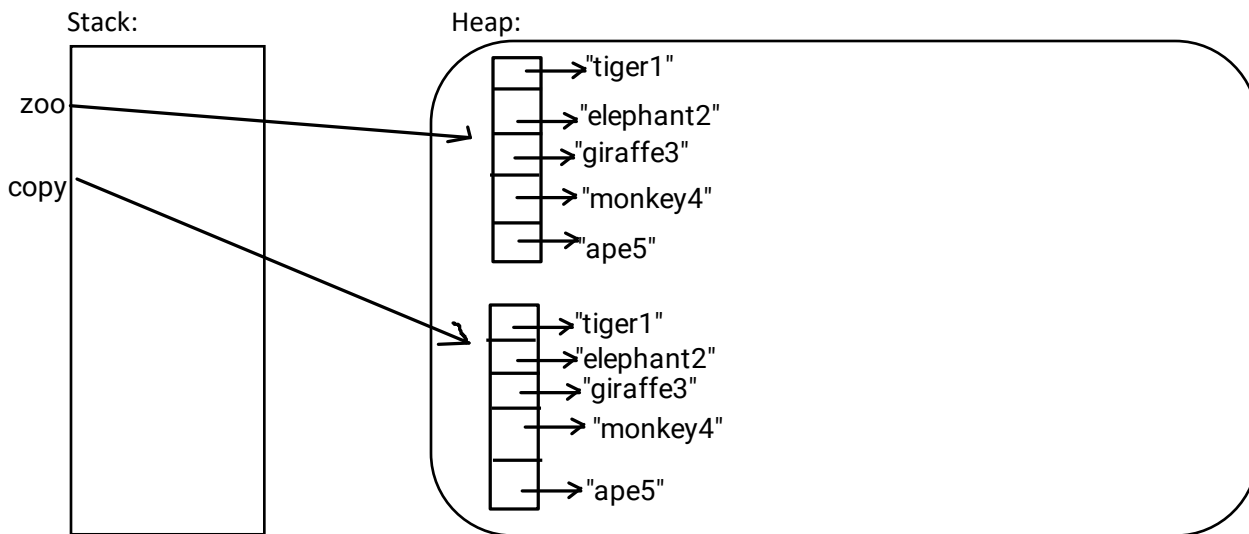
b. Draw the memory map.

Stack: Heap:

zoo →   "tiger1"

copy →   "elephant2"

                                   "giraffe3"

                                   "monkey4"

                                   "ape5"

5. a. Write the deep copy of the following in code.

   Animal[] zoo = {tiger1, elephant2, giraffe3, monkey4, ape5};
   Animal[] copy;

   b. Draw the memory map.

Stack:

zoo

copy

Heap:

"tiger1"

"elephant2"
"giraffe3"

"monkey4"

"ape5"

"tiger1"
"elephant2"
"giraffe3"

"monkey4"

"ape5"

6. What is garbage collection? Where does it happen?

Garbage collection is an automated process that assists programmers by getting rid of the memory that is no longer being used. The garbage collection happens on the Java Virtual Machine.

7. What is the difference between the two operators, equals() and ==?

== is used for address comparison whereas equals() is used to compare string and other non-primitive data type values. .equals is also a method, while == is an operator.