This worksheet serves as a review for concepts that do not appear on Sherif's practice exam. This is not a comprehensive way to prepare for the midterm.

Problem 1

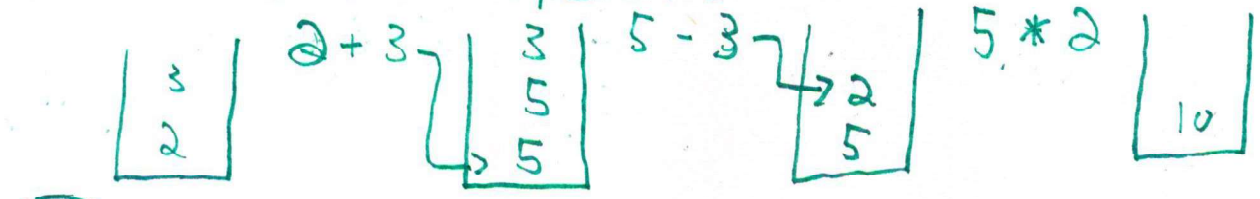
Calculate the value of the following expressions in post-fix notation. You must use a stack. Please show your work.

$$2\ 3+5\ 3-* \tag{1}$$

$$5\ 12*6+2- \tag{2}$$

$$2\ 3-7\ 5*5/+ \tag{3}$$

(1) Stack holds operands



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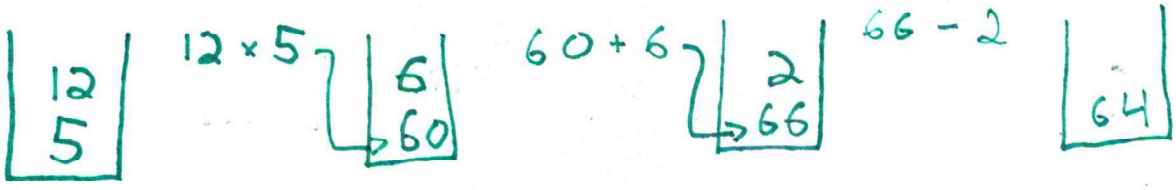
(2)



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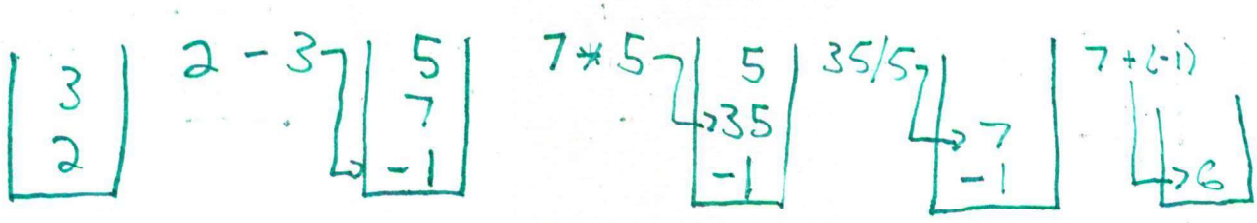
(3)



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Problem 2

Convert the following expressions into post-fix notation. You must use a stack. Please show your work.

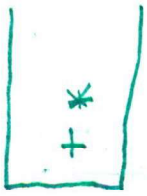
$$3 + 2 * 5 - (4 + 2) \tag{1}$$

$$(A - B) * C \tag{2}$$

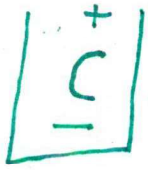
$$A + B - (C - D) * (E + F) * G \tag{3}$$

Stack holds operators, when you see an operand - simply write it down.

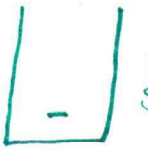
(1) 3 2 5 * + 4 2 + −



after => processing −

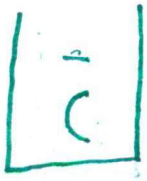


after => processing)



end of => String

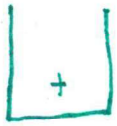
(2) A B − C *



after processing =>)

end of => String

(3) A B + C D − E F + G * −

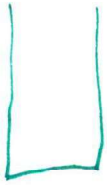


after => processing −

after => processing)

after => processing)

end => of String



Problem 3

True or False. ~~Some recursive algorithms cannot be made iterative.~~

There are some recursive algorithms that can't be made iterative. False.

Problem 4

In one line finish the clear method for a linked stack. Assume the first node is named head.

Listing 1: Finish the method

```
1 public void clear() {
2     // You may only use one line.
3     head = null;
4 }
```

clear here is O(1).

Problem 5

Explain the pros and cons for array based implementations of a bag and linked implementations of a bag. You can assume that the array is resizeable.

Array

Pros

Easy to implement
Contiguous Memory
Stores multiple objects
Generics enforce homogenity
Easy access to elements

Cons

Memory
↳ especially if resizing
Add is slow if resizing
Could be fixed capacity

Linked

Pros

Adding is always O(1)
Make use of java garbage collector
Memory is created/destroyed as needed.

Cons

Difficult to program
Each element has two objects associated w/ it.
Can't access elements directly.

Problem 6

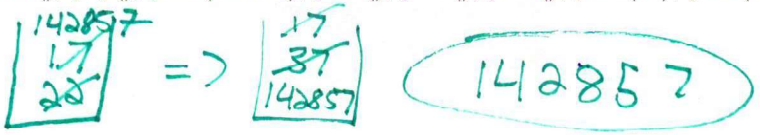
List and explain the three main stack operations.

Push - to top of stack
pop - return and remove from top
peek - return top of stack

Problem 7

What is left on the stack after the following operations?

push(22), pop(), push(17), peek(), pop(), push(142857), peek(), peek(), peek(), push(37), push(17), pop(), peek(), pop().



Problem 8

Write code for the contains(E elem) method for an Array Bag implementation. Pseudocode is fine. Also state the runtime of contains(E elem). Please explain your answer. Assume the array is called bag. For this answer, I assume the bag implementation does not allow nulls.

```
boolean contains(E elem) {
    ~~if (elem != null)~~
    boolean found = false;
    int start = 0;
    if elem is null: or bag is empty:
        return false;
    while not found AND start < size:
        if bag[start].equals(elem)
            found = true;
        else
            found = false;
        start++;
    return found;
}
```

Worst Case O(n) - Element is last in Array.
Best Case O(1) - Element is either null, bag is empty, or elem is first in array.
Avg Case O(n)