CMSC330 Fall 2024 Quiz 4

Proctoring TA: _____ **Name:** _____

Section Number: _____ **UID:** _____

Problem 1: Basics

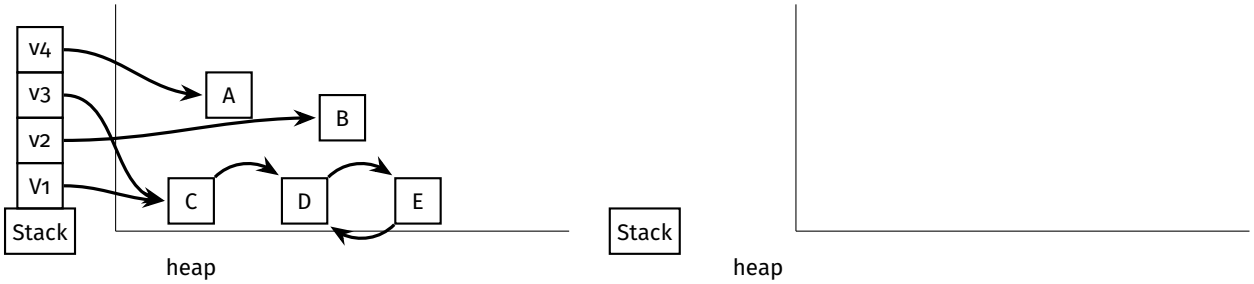
[Total 4 pts]

	True	False
Using only the reference counting garbage collection technique will result in certain data structures not being freed	T	F
Rust's Type System prevents use after free (ignoring the **unsafe** keyword and the RC module)	T	F
A reference's lifetime is part of its type	T	F
A conservative Garbage Collector will not free data if it is unsure if the data is still in use	T	F

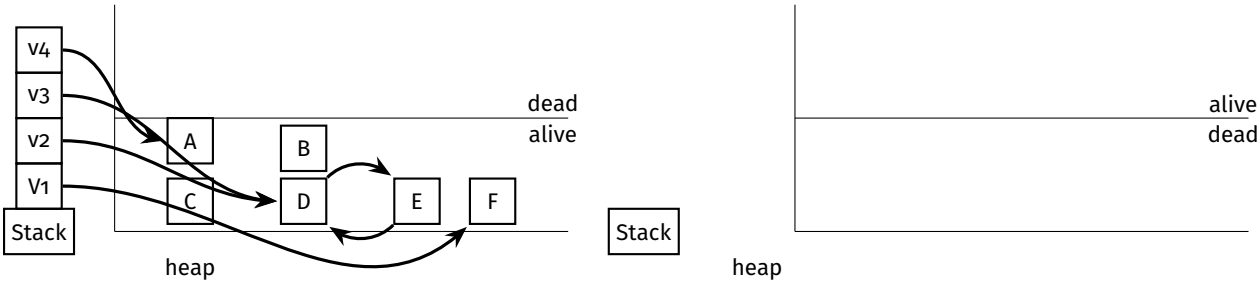
Problem 2: Garbage Collection

[Total 8 pts]

Suppose that *v*4 and *v*3 are popped off the stack. Using the reference counting technique, draw the stack and heap after this occurs.



Suppose you have the following memory diagram. Draw the stack and heap after the stop and copy garbage collection technique is run. Note that nothing is popped off the stack for this question.



Problem 3: Rust Ownership and references

[Total 8 pts]

```
fn main(){
  {
    let mut a = String::from("hello");
    let mut b = String::from("World");
    // Mark 1
    {
      let c = f1(a);
      // Mark 2
      println!("{c}");
    }
    // Mark 3
    let d = f2(&mut b);
    println!("{b}");
    // Mark 4

    b = String::from("Bye");
    println!("{b}");
  }
}

fn f1(mut s: String) -> String{
  s.push_str(" Planet");
  // Mark 5
  s
}

fn f2(x: &mut String)-> usize{
    x.push_str(" domination");
    // Mark 6
    x.len()
}
```

If there is no owner (because the value has been dropped) put "None". Assume that we are asking about ownership **during** execution.

Who is the owner of the String with contents "hello" at Mark 1?

Who is the owner of the String with contents "hello Planet" at Mark 2?

Who is the owner of the String with contents "hello" at Mark 3?

Who is the owner of the String with contents "hello Planet" at Mark 5?

Who is the owner of the String with contents "World domination" at Mark 4?

Who is the owner of the String with contents "World domination" at Mark 6?

What is printed out when this program is run?