CS 4610 Written Assignment 7

Zihao Wang (zw2rf)

April 14, 2014

1 Consider Stop & Copy vs. Mark & Sweep garbage collection

a. Is one of these two GC algorithms 'faster' than the other? Which algorithm needs to be run more frequently?

Stop & Copy algorithm is faster than Mark & Sweep algorithm. Stop & Copy needs to be run more frequently as the memory is divided into two equal segments. Stop & Copy is called when half of the memory is filled up while Mark & Sweep is run when the whole memory is filled up.

b. Does either algorithm use strictly more memory than the other?

Yes, Mark & Sweep uses strictly more memory than Stop & Copy due to the mark bits.

c. Are reference cycles common in everyday data structures?

Normally, reference cycles are not common in everyday data structures.

d. Briefly describe how one might implement a cycle detector. When can a cycle be cleaned?

To implement a cycle detector, we can use a tracing algorithm starting from directly reachable references and mark all the references that are reachable. The unmarked ones with reference count more than 0 are included in a reference cycle. This is similar to the mark phase of Mark & Sweep. It should be called periodically.

2 Suppose we want to add a new construct to the language: protect e

a. Give the new type rules for protect, try/catch and throw

throw

$$\frac{O, M, C \vdash e : T_1, E_1}{O, M, C \vdash throw\ e : T_2, true}$$

try/catch

$$\frac{O, M, C \vdash e_0 : T_0, E \qquad O\left[Object/x\right], M, C \vdash e_1 : T_1, E'}{O, M, C \vdash try\ e_0\ catch\ x : Object \Rightarrow e_1 : T_0 \sqcup T_1, false}$$

protect

$$\frac{O, M, C \vdash e : T, false}{O, M, C \vdash protect\ e : T, false}$$

b. Give a code sample that illustrates that the typing system described here is not necessarily safe.

```
protect {
        try {
                throw e
        } catch x {
                throw e
        }
}
```

This codes passes the type check as the **try/catch** block returns false since it catches all types of exceptions. Therefore, throwing an exception in the **catch** blocks fools the compiler to type check the program.