Programming in C and C++
Supervision 2

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You may email me your work or leave it in my pigeonhole in the Trinity College Great Court mail room.
Please submit the assigned work at least 24 hours before the supervision!

1 Before attempting the problems

This exercise sheet mainly covers lectures 5–7: tools, region/arena-style allocation, and the garbage collection approach to memory management. It mostly reinforces the ideas about heap allocation seen in the previous supervision. There are a few questions going outside of these lectures or referring to earlier material.

This sheet is shorter because it refers to the most practical part of the course. The labs will take much more of your time than these questions!

Note the somewhat nonstandard distinction in the notes between GC and reference counting. You will more frequently see reference counting referred to as a possible approach to GC, and the other approach referred to as tracing GC. This exercise sheet uses the convention used by the course, but note that *Compiler Construction* will take a different approach!

2 Problems

1. The lecture notes introduce a 'trick' called *Duff's device*. Why is it used and how does it work?
2. What is the difference between an *address sanitiser* and a *memory sanitiser*?
3. Look up (and possibly try out) `gdb` and `lldb` debuggers. What are *breakpoints*, *watchpoints* and *catchpoints*?
4. What is an *arena* in terms of memory management (sometimes referred to as a region)? Describe the benefits and downsides of using this pattern.
5. What makes freeing graphs and directed acyclic graphs (DAGs) possibly difficult?

6. Compare and contrast *manual memory management*, *reference counting*, and *garbage collection*. What are their use cases? Can you compare the latter two approaches to memory management to create a 'best of both worlds' garbage collector?
7. Attempt past exam question: 2010 Paper 3 Question 6.

Remember to submit your solutions to the labs associated with lectures 5, 6, 7.