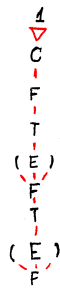


I2OS 22 Final Exam Solutions

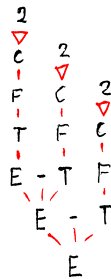
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June 26, 2023

1. (a) The result = $\boxed{1}$



- (b) The result = $2 - 2 - 2 = 0 - 2 = \boxed{-2}$



- (c) The result = $(3/3)/3 = 1/3 = \frac{1}{3} \simeq \boxed{0}$

5.

```
moveg2s 0 7    // mode = 0
```

This would set the mode to *system* enabling access to all addresses in the memory, since address translation (required by user mode) wouldn't be required.
6. If we don't do anything special in the kernel (like overwriting *gpr*(0)) nothing will change, except the fact that users won't be able to access *gpr*(0) and will have to account for that by possibly redeclaring another *gpr* as a zero — always keeping 0₃₂ in that *gpr*.
7. (a) $4 \cdot (32 + 1) = 128 + 4 = 132$
(b) $2 \cdot 4 \cdot (32 + 8) = 8 \cdot 40 = 320$
(c) $320 + 4 \cdot 3 = 332$
8. (a) For function calls.
(b) To enable the use of local variables.
9. The given invariants allow us to save and restore user and kernel state.
10. (a) $2^{15} - 2$ forwards and $2^{15} - 1$ backwards
(b)
 - For if-parts in the case of an if-then statement: $2^{15} - 2$. In the case of an if-else statement: $2^{15} - 3$.
 - For else-parts: $2^{15} - 2$
 - For while bodies: $2^{15} - 2 - |\text{code}(n1)|$, where $n1$ is the while condition.
11. (a)