1 Computer Design (swm11)

(a) Moore’s law and Dennard scaling both predict scaling properties of CMOS chips. What are the differences between these predictions and which predictions are valid today? [4 marks]

(b) How is the critical path in a clocked digital CMOS circuit determined and how does it impact the maximum clock frequency? [4 marks]

(c) What is a function calling convention and how does it impact the design of the RISC-V instruction set architecture (ISA)? [4 marks]

(d) Consider the following C function that computes the greatest common divisor, and the assembler produced by the compiler. The assembler has been split into segments. Describe what function each segment performs. [8 marks]

```c
int gcd(int n1, int n2) {
    if (n2 == 0)
        return n1;
    else
        return gcd(n2, n1 % n2);
}
```

##### Segment A #####

gcd:
    bne a1,zero,.L7
    jr ra

##### Segment B #####

.L7:
    addi sp,sp,-16
    sw ra,12(sp)

##### Segment C #####

    mv a5,a1
    rem a1,a0,a1
    mv a0,a5
    jalr ra, gcd

##### Segment D #####

    lw ra,12(sp)
    addi sp,sp,-16
    jr ra