Quiz 1

Alloted time: 45 minutes

Instructions:

- There are two questions with sub-parts, printed over two sides of a sheet.

- Discussions amongst the students are not allowed. Any dishonesty shall be penalized heavily.

- Be clear in your arguments. Vague arguments shall not be given full credit.

1. Consider a 5-bit floating-point representation based on the IEEE floating-point format, with one sign bit, two exponent bits ($k = 2$), and two fraction bits ($n = 2$).

   (a) Compute the bias.

   (b) Compute e, E, f, M and the fractional value for each of the following 5 bit floating point representations: 0 00 01, 0 00 11, 0 01 10, 1 01 11, 0 10 01 and 0 01 00.

e	:	The value represented by considering the exponent field to be an unsigned integer
E	:	The value of the exponent after biasing
f	:	The value of the fraction
M	:	The value of the significand
$2^E \times M$	:	The (unreduced) fractional value of the number

   (c) Compute the value of the smallest normalized number and the largest denormalized numbers under the given 5-bit floating point representation.

   [2 + (6 x 5 x 0.5) + 3 marks]

2. The following (uncommented) assembly code was modified from what was discussed in class.

```
.factorial:
        cmp r0, 1
        beq .return
        bgt .continue
        b .return
.continue:
        sub sp, sp, 8
        st r0, [sp]
        st ra, 2[sp]
        sub r0, r0, 1
        call .factorial
        ld r0, [sp]
```

```
        ld ra, 2[sp]
        mul r1, r0, r1
        add sp, sp, 8
        ret
.return:
        mov r1, 1
        ret
.main:
        mov r0, 3
        call .factorial
```

Can you write the sequence of register and memory updates done by the program. If there are inaccuracies, can you point them out (with formal explanation) and fix them?   [10 marks]