5)

a) 2.718

$2 = (10)_2$

0.718 =

$0.718 \times 2 = 1.436$	1
$0.436 \times 2 = 0.872$	0
$0.872 \times 2 = 1.744$	1
$0.744 \times 2 = 1.488$	1
$0.488 \times 2 = 0.976$	0
$0.976 \times 2 = 1.952$	1
$0.952 \times 2 = 1.904$	1
$0.904 \times 2 = 1.808$	1
$0.808 \times 2 = 1.616$	1
$0.616 \times 2 = 1.232$	1
$0.232 \times 2 = 0.464$	0
$0.464 \times 2 = 0.928$	0
$0.928 \times 2 = 1.856$	1
$0.856 \times 2 = 1.712$	1
⋮	

$2.718 = (10.1011011111\ldots)$

$= 1.0101101111 \times 2^1$

$= 1.0110 \times 2^1$

sign = 0

bias = 3

exponent = 3+1 = 4

mantissa = 0110

0 100 0110 ⟹ 8-bit representation (format)

b) (1o1ooIII) to decimal

1 | o1o | oIII

sign | exponent | mantissa

exponent = 2 - 3 = -1 $(o1o)_2$ - bias

mantissa = 1.oIII

$1.oIII \times 2^{-1} = 0.1oIII = 2^{-1} + 2^{-3} + 2^{-4} + 2^{-5}$

$= 0.71875$

c)

$\epsilon_{mach} = 2^{-b} \rightarrow 2^{-4} = \frac{1}{16}$

upper bound of the relative error $= \frac{1}{2} \epsilon_{mach}$

$= \frac{1}{2} \times \frac{1}{16}$

$= \frac{1}{32}$