KFUPM - COMPUTER ENGINEERING DEPARTMENT

COE-202 – Fundamentals of Computer Engineering (section 02)

Student Name:
Student Number:

You MUST SHOW your work – correct results without showing leading work do not count!

1) (15 points) Analog versus Digital Systems:
   a. What is the difference between analog and digital systems?
   b. Which systems are easier to design?
   c. What is meant by "Quantization"? and what is the device that performs quantization?

Solution:

1.a) Analog systems deal with continuous range of values while digital systems deal with a finite set of values.

1.b) Digital systems are easier to design

1.c) Quantization is the process of digitizing the analog signal and converting it to discrete/digital. The device is the "Analog to digital converter".

2) (40 points) Number systems:
   a. What is the octal equivalent of $(32.57)_{10}$?
   b. What is the binary equivalent of $(32.57)_{10}$?
   c. If a BINARY number A is represented by $A_1A_0.A_{-1}$ (i.e. 2 digits for the integer part and 1 digit for the fraction part), what are the smallest nonzero and largest numbers that can be represented? specify the decimal value as well.
   d. What is 16^3-16^2 in hex and decimal systems? *Hint: Perform the subtraction in hex and then convert to decimal.*

Note: in your number conversions, include only the first four fraction digits

Solution:

2.a) 32_{10} ➔ 32/8 = 4 and remainder is 0 → 0

4/8 = 0 and remainder is 4 → 4 ➔ hence, $32_{10} = 40_8$

$(0.57)_{10}$ ➔ 0.57 X 8 = 4.56 → 4

0.56 X 8 = 4.48 → 4

0.48 X 8 = 3.84 → 3

0.84 X 8 = 6.72 → 6 ➔ hence, $(0.57)_{10} = (0.4436)_8$

Therefore, $(32.57)_{10} = (40.4436)_8$

2.b) We can perform the procedure in (2.a) but replacing base 8 with base 2. Alternatively, we can convert the result of (2.a) directly to binary by replacing every Octal digit by its 3-bit binary equivalent. Therefore $(32.57)_{10} = (40.4436)_8 = (100\ 000.\ 100\ 100\ 011\ 110)_2$.

2.c) Smallest nonzero number is $(00.1)2 = (0.5)_{10}$. The largest is $(11.1)2 = (3.5)_{10}$.

2.d) $(16^3)_{16}-(16^2)_{16}= (1000)_{16} - (100)_{16} = (F00)_{16}$. The value of $(F00)_{16}$ is $15x16^2 = (3840)_{10}$.