Number Systems - Tutorial Sheet

www.MathsResource.com

May 16, 2015

Question 1 : Binary numbers

(a) Express the following binary numbers as decimal numbers

(i) 101
(ii) 1101
(iii) 11011
(iv) 100101

(b) Express the following decimal numbers as binary numbers

(i) 6
(ii) 15
(iii) 37
(iv) 77

Question 2

A number is expressed in base 5 as $(234)_5$. What is it as decimal number? Suppose you multiply $(234)_5$ by 5. what would be the answer in base 5.

Question 3

Perform the following binary additions

(i) $1011 + 1111$
(ii) $10101 + 10011$
(iii) $1010 + 11010$
(iv) $101010 + 10101 + 101$

Question 4

Perform the binary additions

- $(10111)_2 + (111010)_2$
- $(1101)_2 + (1011)_2 + (1111)_2$

Question 5

Perform the binary subtractions using both the bit-borrowing method and the two's complement method.

- $(1001)_2 - (111)_2$
- $(110000)_2 - (10111)_2$

Question 6

Perform the binary multiplications

- $(1101)_2 \times (101)_2$
- $(1101)_2 \times (1101)_2$

Question 7

(a) What is highest Hexadecimal number that can be written with two characters, and what is it's equivalent in decimal form? What is the next highest hexadecimal number?

(b) Which of the following are not valid hexadecimal numbers?

(i) A5G
(ii) 73
(iii) EEF
(iv) 101

Question 8 : Binary Substraction

Exercises:

(i) 110 - 10

(ii) 101 - 11

(iii) 1001 - 11

(iv) 10001 - 100

(v) 101001 - 1101

(vi) 11010101-1101

Question 9

(a) Suppose 2341 is a base-5 number Compute the equivalent in each of the following forms:

(i) decimal number

(ii) hexadecimal number

(iii) binary number

(b) Perform the following binary additions

(i) $1011 + 1111$

(ii) $10101 + 10011$

(iii) $1010 + 11010$

Question 10

Calculate working in hexadecimal

- $(BBB)_{16} + (A56)_{16}$
- $(BBB)_{16} - (A56)_{16}$

Question 11

Write the hex number $(EC4)_{16}$ in binary. Write the binary number $(11110110101|)_2$ in hex.

Question 12

Express the decimal number 753 in binary , base 5 and hexadecimal.

Question 13

Express 42900 as a product of its prime factors, using index notation for repeated factors.

Question 14

Expresse the recuring decimals

(i) $0.727272\ldots$

(ii) 0.126126126....

(iii) 0.7545454545...

as rational numbers in its simplest form.

Question 15

Given that π is an irrational number, can you say whether $\frac{\pi}{2}$ is rational or irrational. or is it impossible to tell?

Question 16

(i) Given x is the irrational positive number $\sqrt{2}$, express x^8 in binary notation

(ii) From part (i), is x^8 a rational number?

Question 17

(i) 5/7 lies between 0.714 and 0.715.

(ii) $\sqrt{(}2)$ is at least 1.41.

(iii) $\sqrt{(}3)$ 9s at lrast 1.732 and at most 1.7322.

Question 18

(i) Write down the numbers 0.0000526 in floating point form.

(ii) How is the number 1 expressed in floating point form.

Question 19

- Deduce that every composite integer n has a prime factor such that $p \leq \sqrt{n}$.
- Decide whether 899 is a prime.

Question 20

- What would be the maximum numbber of digits that a decimal fraction with denominator 13 could have in a recurring block in theory?
- Can you predict which other fractions with denominator 13 will have the same digits as 1/13 in their recurring block?