CS 133 Assignment 1

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1. Convert the following numbers from decimal to binary

a) 217.75

Binary: **11011001.11**

b) -14.125

Binary: **-1110.001**

2. Convert the following numbers from binary to decimal

a) 11011.0011

Decimal: **27.1875**

b) -0.0101

Decimal: **-0.3125**

3. Represent the following binary real number as a single-precision floating point number

Binary: 11011.0011

Normalized representation: 1.10110011 x 10100

Mantissa: 1.10110011

Exponent: 100

Sign bit: 0

Adjusted exponent: 1000 0011

Adjusted mantissa: 1011 0011 0000 0000 0000 000

Single-precision floating point number representation:

**0 1000 0011 1011 0011 0000 0000 0000 000**

4. Use the figure below to answer the following questions

a) Represent the vector a= AB in Cartesian representation

**a = (2, -2)**

b) Compute the angle between AB and the positive x-axis

Angle between AB and +x-axis = tan-1(y/x)

θ = tan-1(2/2) = **45 degree**

c) Compute the angle between BD and the positive x-axis

Angle between BD and +x-axis = tan-1(y/x)

θ = tan-1(2/2) = **45 degree**

d) Compute the angle between AB and BD

Angle between AB and BD = (180 – θs from (a) and (b))

θ = 180 – 45 – 45 = **90 degree**

e) Compute the cross product AB x BD in 2 different ways

Let ‘AB’ be ‘a’ and ‘BD’ be ‘b’. Such that ‘AB x BD’ is ‘a x b’

1. a x b = ||a||||b||sin(θ)n

=> ||a|| = sqrt(a12 + a22) = sqrt(4 + 4) = 2.828

=> ||b|| = sqrt(a12 + a22) = sqrt(4 + 4) = 2.828

=> a x b = (2.828)(2.828)sin(90)n = 0

=> Thus, AB x BD = **0**

2. a x b = a1b2 – a2b1

=> (2\*2) – (2\*2) = 0

=> Thus, AB x BD = **0**

f) Compute the dot product AB ∙ BD in 2 different ways

1. a ∙ b = ||a||||b||cos(θ)

=> ||a|| = sqrt(a12 + a22) = sqrt(4 + 4) = 2.828

=> ||b|| = sqrt(a12 + a22) = sqrt(4 + 4) = 2.828

=> a ∙ b = (2.828)(2.828) = 8

=> Thus, AB ∙ BD = **8**

2. a ∙ b = a1b1 + a2b2

=> (2\*2 + 2\*2) = 8

=> Thus, AB ∙ BD = **8**

g) Compute the coordinates of the intersection between B’D and A’C

Here, B’ = inverse of B => B’(0, 2)

A’ = inverse of A => A’(2, 0)

Converting B’D and A’C to y-equation:

B’D => y = 0x + 2

A’C => y = 1/3x – 2/3

Then, with two equations for the two lines B’D and A’C, the intersection point is **(8, 2)**