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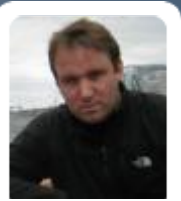
# HIBERNIA COLLEGE DUBLIN

## Computing



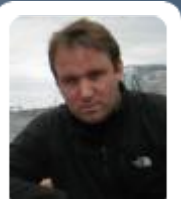
**Tutor :** Kevin O'Brien

**Tutorial:** Maths for Computing



## Overview of Tutorial

- First two chapter of Study Guide
  - Chapter 1 : Number Systems
  - Chapter 2 : Set Theory and Binary Operations
- Subject Matter for Tutorial
  - Selected end of chapter revision questions
  - Selected past paper questions
- Also
  - Questions and Queries
  - We will open the discussion now, and continue at the forthcoming onsite tutorial



## Chapter 1: Number Systems

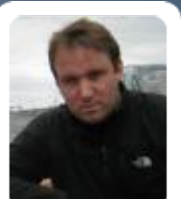
- Three main number systems
  - Decimal (i.e. 0,1,2,3,4,5,6,7,9)
  - Binary (i.e. 0,1)
  - Hexadecimal (i.e. 0,1)
- Key Objectives
  - Converting from one number system to another.
  - Performing arithmetic operations (e.g. binary addition and subtraction)



## The Binary System

(1.1.2. pg 3)

- Task: Converting decimal numbers to binary
- “Express the decimal number  $(347)_{10}$  in base 2”
  - Taken from 2010 Zone A Examination paper – Q1c (2 Marks)
  - Worked Example on Next Slide
  - Correct Answer - 101011011
  - Make a note of correct answer. I have a question at the end of the working!



## Decimal to Binary Conversion

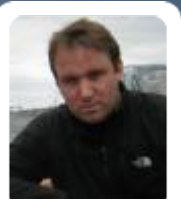
	Number	Divided by 2	Quotient	Remainder
1	347	173.5		
2				
3				
4				
5				
6				
7				
8				
9				
10				



## The Binary System

(1.1.2. pg 3)

- Task: Converting binary numbers to decimal
- “Express the binary number  $(1011.011)_2$  as a decimal, showing all your workings.”
  - Taken from 2010 Zone A Examination paper – Q1b (2 Marks)
  - Worked Example on Next Slide
- Important points
  - Anything to the power of zero is 1.
  - Demonstration of Negative Powers



## Decimal to Binary Conversion

Number	Power of 2	Component	Multiple
1	3	8	
0	2	4	
1	1	2	
1	0	1	
.	.	.	.
0	-1	0.5	
1	-2	0.25	
1	-3	0.125	
		Total =	



## Binary Addition

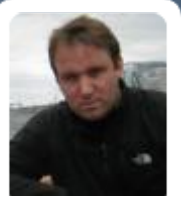
- Fundamental Operations
  - All digits below are binary
  - Two Basic Operations
    - $0 + 0 = 0$
    - $1 + 0 = 1$     **also**    $0 + 1 = 1$
  - Two More Advanced Operations
    - $1 + 1 = 10$  ( i.e. 0   carry the 1)
    - $1 + 1 + 1 = 11$  ( i.e. 1   carry the 1)
- Task: carry out the following binary addition :  **$10101 + 11011$** 
  - Taken from 2010 Zone A Q1a





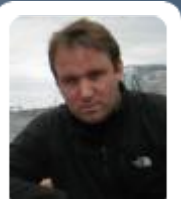
## Binary Addition ( part of 2010 Q1a)

1	0	1	0	1
1	1	0	1	1



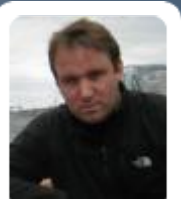
## Binary Subtraction

- Use the concept of “borrowing”
- Use basic operations from binary addition, but in reverse.
- Important
  - $10 - 1 = 1$
- Task: carry out the following binary addition : **110000 - 10111**
  - Taken from Study guide Exercises Q5 pg 16
  - ( Decimal Equivalent: 48-23)



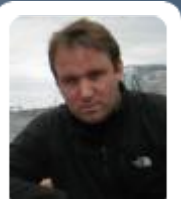
## Binary Subtraction

1	1	0	0	0	0
	1	0	1	1	1



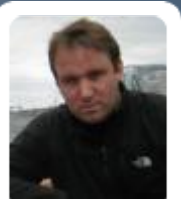
## Binary Multiplication

- Follows on from Binary Addition
- Additional Skill : Left Shifting
- Task: carry out the following binary addition : **1101 x 1101**
  - Taken from Study guide Exercises Q5 pg 16
  - ( Decimal Equivalent: 13 x 13)



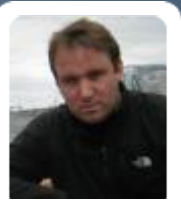
## Binary Multiplication

1	1	0	1
1	1	0	1



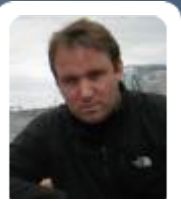
## Binary Division

- Follows on from Binary Subtraction
- Task: carry out the following binary division : **111011    101**
  - Taken from Study guide Exercises Q7 pg 17
  - ( Decimal Equivalent: 59    5)



## Binary Division

1 1 1 0 1 1



# Hexadecimal Conversion

- Convert a Hexadecimal to Decimal

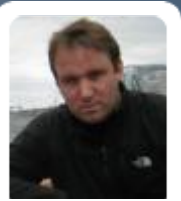
Hex	Dec	Hex	Dec	Hex	Dec	Hex	Dec
0	0	4	4	8	8	C	12
1	1	5	5	9	9	D	13
2	2	6	6	A	10	E	14
3	3	7	7	B	11	F	15





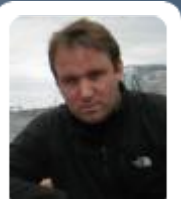
## Hexadecimal Conversion

- Task: Converting hexadecimal numbers to decimal
- Convert the number  $(A5d)_{16}$  to decimal form (Answer : 2653)
  - Based on Question 10, page 17
- (Recall - anything to the power of zero is 1)
- $A \times 16 \quad + \quad 5 \times 16 \quad + \quad D \times 16$



## New Section: Set Theory and Binary Operations

- Membership Tables
- Venn Diagrams
- Power Sets
- Notation: Union “ $\cup$ ” and Intersection “ $\cap$ ”
  - Relationship with Logical “AND” and “OR” in Chapter 3.
- Complement of  $A$  is denoted “ $A^c$ ”



## Membership Tables

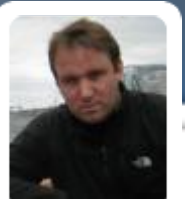
A	B	C					
0	0	0					
0	0	1					
0	1	0					
0	1	1					
1	0	0					
1	0	1					
1	1	0					
1	1	1					



## Membership Tables : Set and Symmetric Difference

A	B	$A - B$	$B - A$	$A \oplus B$		
0	0					
0	1					
1	0					
1	1					

See Page 25 : Definitions 2.15 and 2.16



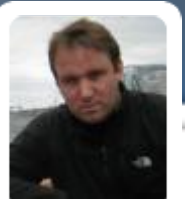
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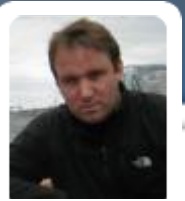
## Membership Tables : Set and Symmetric Difference

A	B	C	A-B	B-A	B-C	(A-B)-C	A-(B-C)
0	0	0					
0	0	1					
0	1	0					
0	1	1					
1	0	0					
1	0	1					
1	1	0					
1	1	1					

See Page 31 Q 10 a

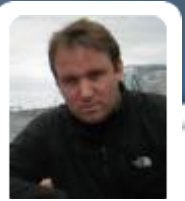


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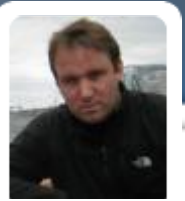


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