Digital Design, A Datapath and Control Approach - The Solutions Manual

Chris Coulston

Digital Design

A Datapath and Control Approach

Chris Coulston
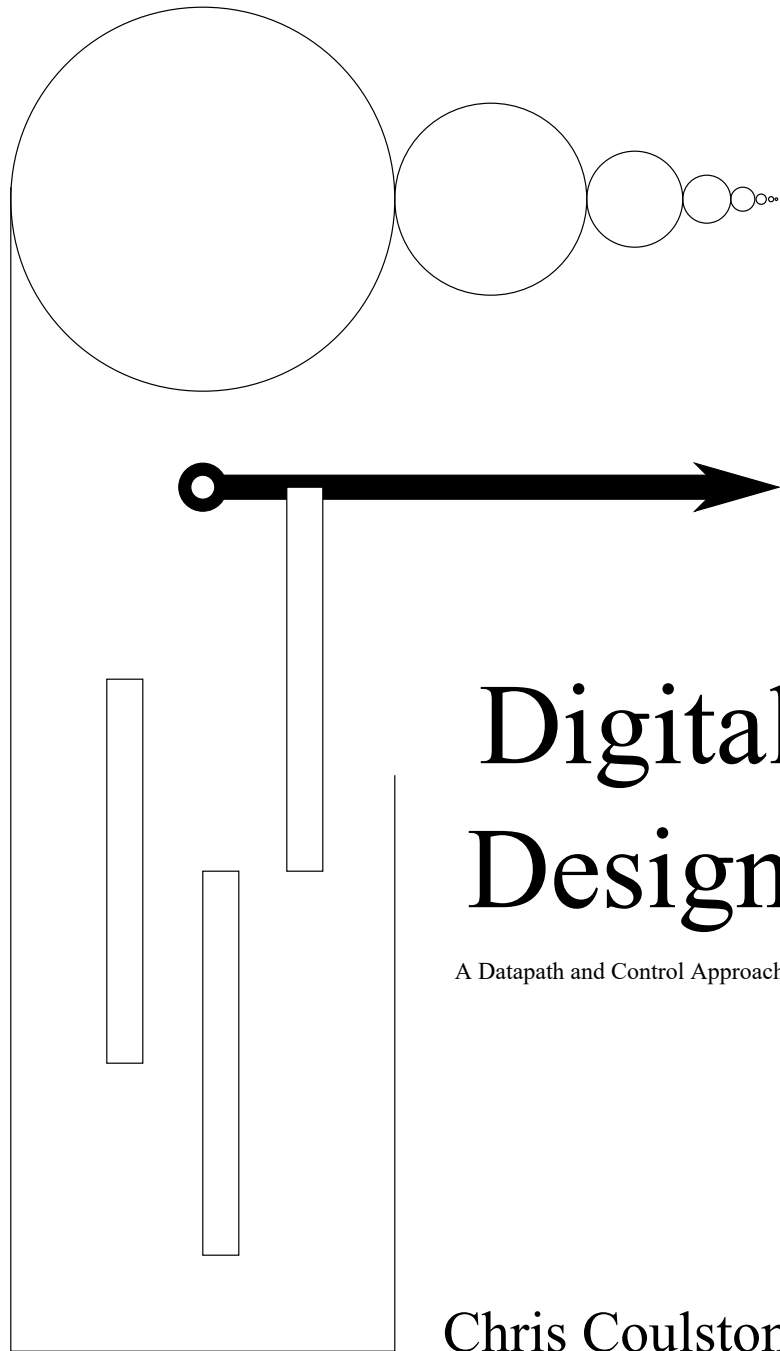
Contents

Chapter 1

Numbering Systems

1.1   Exercises

1. **(1 pt. each)** Syllabus:

    a) What is the late penalty for homework?
       There is a 33% deduction per day.

    b) True or False: Calculators can be used during exams.
       You cannot use calculators at my exams.

    c) True of False: University ID is required during exams.
       I check ID at the exams. After I learn your names its not such a big deal, but bring it to be safe.

    d) What is my thesis regarding grades?

    e) Bob L. Student has the following grades. Determine his final overall course percentage and grade.

Component	Percentage
Homework	60%
Exam 1	90%
Exam 2	80%
Final	70%

Component	Percentage	Weight
Homework	*60%*	*60*0.35 = 21*
Exam 1	*90%*	*90*0.20 = 18*
Exam 2	*80%*	*80*0.20 = 16*
Final	*70%*	*70*0.25 = 17.5*
Total	*72.5%*	*C*

    f) How should you prepare for the 43rd lecture?
       Look over homework problem 8.10, page 165

2. **(1 pt. each)** Convert the following numbers to decimal. Show work, or receive 1/2 credit.

    a) 100_2 $100_2 = 2^2 = 4_{10}$

    b) 1000_2 $1000_2 = 2^3 = 8_{10}$

    c) 10000_2 $10000_2 = 2^4 = 16_{10}$

    d) 100000_2 $100000_2 = 2^5 = 32_{10}$

    e) 111111_2 $111111_2 = 2^5 + 2^4 + 2^3 + 2^2 + 2^1 + 2^0 = 63_{10}$

    f) 1000100101000101_2 $1000100101000101_2 = 2^{15} + 2^{11} + 2^8 + 2^6 + 2^5 + 2^0 = 35141_{10}$

    g) $3EA_{16}$ $3EA_{16} = 001111101010 = 2^9 + 2^8 + 2^7 + 2^6 + 2^5 + 2^3 + 2^1 = 1002_{10}$

3. **(1 pt. each)** Convert the following number to binary. Show work, or receive 1/2 credit.

    a) 44_{16} $44_{16} = 01000100_2$

    b) 44_{10} $44_{10} = 32 + 8 = 2^5 + 2^3 = 101100_2$

    c) 1023_{10} $1023_{10} = 512 + 256 + 128 + 64 + 32 + 16 + 8 + 4 + 2 + 1 = 2^9 + 2^8 + 2^7 + 2^6 + 2^5 + 2^4 + 2^3 + 2^2 + 2^1 + 2^0 = 1111111111_2$

4. **(1 pt. each)** Convert the following number to hex. Show work, or receive $1/2$ credit.

    a) 101011101_2 $101011101_2 = 15D_{16}$

    b) 77_{10} $77_{10} = 64 + 8 + 4 + 1 = 2^6 + 2^3 + 2^2 + 2^0 = 1001101_2 = 4D_{16}$

5. **(2 pts. each)** Toughies:

    a) Convert 123_5 to base-12 $123_5 = 1 * 5^2 + 2 * 5^1 + 3 * 5^0 = 25 + 10 + 3 = 38_{10} = 3 * 12^1 + 2 * 12^0 = 32_{12}$

    b) Convert 789_{12} to base-5 $789_{12} = 7 * 12^2 + 8 * 12^1 + 9 * 12^0 = 1008 + 96 + 9 = 1113_{10} = 1 * 5^4 + 3 * 5^3 + 4 * 5^2 + 2 * 5^1 + 3 * 5^0 = 13423_5$

    c) What is the largest base-10 quantity that can be represented using 5 digits in base 12?

    $BBBBB_{12} = 11 * 12^4 + 11 * 12^3 + 11 * 12^2 + 11 * 12^1 + 11 * 12^0 = 248831_{10}$

6. **(1 pt. each)** Perform the following additions, assume a word size of four bits. Determine if overflow occurs.

    a) $0110_2 + 0101_2$ *0110 + 0101 = 1011*

    b) $0010_2 + 0110_2$ *0010 + 0110 = 1000*

    c) $0111_2 + 0011_2$ *0111 + 0011 = 1010*

    d) $0010_2 + 0101_2$ *0010 + 0101 = 0111*

    e) $0010_2 + 1010_2$ *0010 + 1010 = 1100*

    f) $0101_2 + 1011_2$ *0101 + 1011 = 10000 overflow*

    g) $0011_2 + 1001_2$ *0011 + 1001 = 1100*