Problem 1 (40 Points)

(a) Convert 53.7_{10} to binary

(b) Convert 20_7 into binary and then into hexadecimal

(c) Perform the binary subtraction $111001 - 1011$

(d) Perform binary multiplication 1101×1011

(e) Find the quotient and remainder when dividing binary number 10010001 by 1011

(f) Represent -5 and -6 as $2's$ complement numbers and then add them together. Is there an overflow?

(g) Represent -5 and 6 as $1's$ complement numbers and then add them together. Is there an overflow?

(h) Using a 5-2-2-1 weighted code for decimal digits, what number does $1110\,0110$ represent?

Problem 2 (20 Points)

(a) Draw the schematic and create a truth table for the Boolean function $F = A' + B$

(b) Simplify $Z = A'BC + A'$

(c) Simplify $Z = [A + B'C + D + EF][A + B'C + (D + EF)']$

(d) Simplify $Z = (AB + C)(B'D + C'E') + (AB + C)'$

Boolean Laws and Theorems

$X + 0 = X$, $X + 1 = 1$, $X \cdot 1 = X$, $X \cdot 0 = 0$, $X + X = X$, $X \cdot X = X$, $(X')' = X$, $X + X' = 1$, $X \cdot X' = 0$,
$X + Y = Y + X$, $XY = YX$, $(X + Y) + Z = X + (Y + Z)$, $(XY)Z = X(YZ)$, $X(Y + Z) = XY + XZ$,
$X + YZ = (X + Y)(X + Z)$, $(X + Y)' = X'Y'$, $(XY)' = X' + Y'$, $XY + XY' = X$, $(X + Y)(X + Y') = X$,
$X + XY = X$, $X(X + Y) = X$, $X + X'Y = X + Y$, $X(X' + Y) = XY$, $(X + Y + \cdots)^D = XY\cdots$, $(XY\cdots)^D =$
$X + Y + \cdots$, $(X + Y)(X' + Z) = XZ + X'Y$, $XY + X'Z = (X + Z)(X' + Y)$, $XY + YZ + X'Z = XY + X'Z$,
$(X + Y)(Y + Z)(X' + Z) + (X + Y)(X' + Z)$