**Pseudocode**

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**Problem 1 pseudocode:**

**function checkhexadecimal (number):**

**return all(char in '0123456789ABCDEFabcdef'for char in str(number))**

**function checkdecimal (number):**

**return all(char in '0123456789'for char in str(number) )**

**function checkbinary (number):**

**return all(char in '01'for char in str(number))**

**function checkoctal (number):**

**return all(char in '01234567'for char in str(number))**

**function decimaltobinary(number):**

**number = int(number)**

**binarynumber = i =0**

**while (number!=0):**

**binarynumber = binarynumber + (number%2)\*(10\*\*i)**

**number = number//2**

**i+=1**

**print(binarynumber)**

**function decimaltooctal(number):**

**number = int(number)**

**octalnumber = i =0**

**while (number!=0):**

**octalnumber = octalnumber + (number%8)\*(10\*\*i)**

**number = number//8**

**i+=1**

**print(octalnumber)**

**function binarytodecimal (number):**

**number = int(number)**

**decimalnumber = i =0**

**while (number!=0):**

**decimalnumber = decimalnumber + (number%10)\*(2\*\*i)**

**number = number//10**

**i+=1**

**print(decimalnumber)**

**function binarytooctal (number):**

**number = int(number)**

**decimalnumber = i =0**

**while (number!=0):**

**decimalnumber = decimalnumber + (number%10)\*(2\*\*i)**

**number = number//10**

**i+=1**

**j = octalnumber = 0**

**while decimalnumber > 0:**

**octalnumber = octalnumber + (decimalnumber % 8)\*(10\*\*j)**

**decimalnumber = decimalnumber // 8**

**j += 1**

**print(octalnumber)**

**function octaltodecimal (number):**

**number = int(number)**

**decimalnumber = i =0**

**while (number!=0):**

**decimalnumber = decimalnumber + (number%10)\*(8\*\*i)**

**number = number//10**

**i+=1**

**print(decimalnumber)**

**function octaltobinary (number):**

**number = int(number)**

**decimalnumber = i =0**

**while (number!=0):**

**decimalnumber = decimalnumber + (number%10)\*(8\*\*i)**

**number = number//10**

**i+=1**

**j = binarynumber = 0**

**while decimalnumber > 0:**

**binarynumber = binarynumber + (decimalnumber % 2)\*(10\*\*j)**

**decimalnumber = decimalnumber // 2**

**j += 1**

**print(binarynumber)**

**function decimaltohexadecimal (number):**

**number = int(number)**

**hexadecimal\_dictionary = "0123456789ABCDEF"**

**if number == 0:**

**return 0**

**hexadecimalnumber = ""**

**while number > 0:**

**remainder = number%16**

**hexadecimalnumber = hexadecimal\_dictionary[remainder]+hexadecimalnumber**

**number = number//16**

**return hexadecimalnumber**

**function binarytohexadecimal (number):**

**number = int(number)**

**decimalnumber = i = 0**

**while number != 0:**

**decimalnumber = decimalnumber + (number%10)\*(2\*\*i)**

**number = number//10**

**i += 1**

**hexadecimalnumber = decimaltohexadecimal(number)**

**print(hexadecimalnumber)**

**function octaltohexadecimal (number):**

**number = int(number)**

**decimalnumber = i = 0**

**while number != 0:**

**decimalnumber = decimalnumber + (number%10)\*(8\*\*i)**

**number = number//10**

**i += 1**

**hexadecimalnumber = decimaltohexadecimal(number)**

**print(hexadecimalnumber)**

**function hexadecimaltodecimal (number):**

**hexadecimalcharacters = "0123456789ABCDEF"**

**decimalnumber = 0**

**number = str(number)**

**hexadecimallength = len(number)**

**for i in range(hexadecimallength):**

**digit = number[i]**

**if digit in hexadecimalcharacters :**

**counter = 0**

**while counter < len(hexadecimalcharacters) and digit != hexadecimalcharacters[counter]:**

**counter = counter + 1**

**if counter < len(hexadecimalcharacters):**

**power = 1**

**for i in range (hexadecimallength-1-i):**

**power = power \* 16**

**decimalnumber += counter \* power**

**print(decimalnumber)**

**function hexadecimaltobinary (number):**

**hexadecimalcharacters = "0123456789ABCDEF"**

**decimalnumber = 0**

**number = str(number)**

**hexadecimallength = len(number)**

**for i in range(hexadecimallength):**

**digit = number[i]**

**if digit in hexadecimalcharacters :**

**counter = 0**

**while counter < len(hexadecimalcharacters) and digit != hexadecimalcharacters[counter]:**

**counter = counter + 1**

**if counter < len(hexadecimalcharacters):**

**power = 1**

**for i in range (hexadecimallength-1-i):**

**power = power \* 16**

**decimalnumber += counter \* power**

**decimalnumber = int(decimalnumber)**

**binarynumber = j =0**

**while (decimalnumber!=0):**

**binarynumber = binarynumber + (decimalnumber%2)\*(10\*\*j)**

**decimalnumber = decimalnumber//2**

**j+=1**

**print(binarynumber)**

**function hexadecimaltooctal (number):**

**hexadecimalcharacters = "0123456789ABCDEF"**

**decimalnumber = 0**

**number = str(number)**

**hexadecimallength = len(number)**

**for i in range(hexadecimallength):**

**digit = number[i]**

**if digit in hexadecimalcharacters :**

**counter = 0**

**while counter < len(hexadecimalcharacters) and digit != hexadecimalcharacters[counter]:**

**counter = counter + 1**

**if counter < len(hexadecimalcharacters):**

**power = 1**

**for i in range (hexadecimallength-1-i):**

**power = power \* 16**

**decimalnumber += counter \* power**

**decimalnumber = int(decimalnumber)**

**octalnumber = j =0**

**while (decimalnumber!=0):**

**octalnumber = octalnumber + (decimalnumber%8)\*(10\*\*j)**

**decimalnumber = decimalnumber//8**

**j+=1**

**print(octalnumber)**

**menu1 = ("A" , "a" , "B" , "b")**

**menu2 = ("A" ,"a", "B" ,"b", "C" ,"c", "D","d")**

**while True :**

**print("\*\*numbering system converter\*\*")**

**print ("A) insert a new number")**

**print("B) exit program")**

**user\_input = input("please select an option: ")**

**if user\_input in menu1 :**

**break**

**else :**

**print ("please select a valid option")**

**if user\_input == "A" or user\_input == "a":**

**number = input("enter a new number: ")**

**while True :**

**print ("select the base you want to convert from")**

**print("A) decimal")**

**print("B) binary")**

**print("C) octal")**

**print("D) hexadecimal")**

**user\_2input = input("please select an option: ")**

**if user\_2input in menu2:**

**break**

**else :**

**print("please select a valid option")**

**while True :**

**print("select the base you want to convert to")**

**print("A) decimal")**

**print("B) binary")**

**print("C) octal")**

**print("D) hexadecimal")**

**user\_3input = input("please select an option: ")**

**if user\_3input in menu2 :**

**break**

**else :**

**print("please select a valid option")**

**if user\_2input == "A" or user\_2input == "a":**

**if checkdecimal:**

**if user\_3input == "A" or user\_3input == "a":**

**print(number , "is already in decimal")**

**else if user\_3input == "B" or user\_3input == "b":**

**print(decimaltobinary(number))**

**else if user\_3input == "C" or user\_3input == "c":**

**print(decimaltooctal(number))**

**else if user\_3input == "D" or user\_3input == "d":**

**print(decimaltohexadecimal(number))**

**else :**

**print("the number you entered isn't decimal")**

**else if user\_2input == "B" or user\_2input == "b" :**

**if checkbinary:**

**if user\_3input == "A" or user\_3input == "a":**

**print(binarytodecimal(number))**

**else if user\_3input == "B" or user\_3input == "b":**

**print(number , "is already in binary")**

**else if user\_3input == "C" or user\_3input == "c":**

**print(binarytooctal(number))**

**else if user\_3input == "D" or user\_3input == "d":**

**print(binarytohexadecimal(number))**

**else :**

**print("the number you entered isn't binary")**

**else if user\_2input == "C" or user\_2input == "c":**

**if checkoctal:**

**if user\_3input == "A" or user\_3input == "a":**

**print(octaltodecimal(number))**

**else if user\_3input == "B" or user\_3input == "b":**

**print(octaltobinary(number))**

**else if user\_3input == "C" or user\_3input == "c":**

**print(number , "is already in octal")**

**else if user\_3input == "D" or user\_3input == "d":**

**print(octaltohexadecimal(number))**

**else :**

**print("the number you entered isn't octal")**

**else if user\_2input == "D" or user\_2input == "d":**

**if checkhexadecimal:**

**if user\_3input == "A" or user\_3input == "a":**

**print(hexadecimaltodecimal(number))**

**else if user\_3input == "B" or user\_3input == "b":**

**print(hexadecimaltobinary(number))**

**else if user\_3input == "C" or user\_3input == "c":**

**print(hexadecimaltooctal(number))**

**else if user\_3input == "D" or user\_3input == "d":**

**print(number , "is already in hexadecimal")**

**else:**

**print("the number you entered isn't hexadecimal")**

**else if user\_input == "B" or user\_input == "b" :**

**print("thank you for using numbering system converter")**

**problem 2 pseudocode :**

**function checkbinary (number):**

**return all(char in '01' for char in str(number))**

**function onescomplement (binarynumber):**

**result = ""**

**for i from 0 to length(binarynumber)-1:**

**if binarynumber[i] == '0':**

**result += '1'**

**else if binarynumber[i] == '1':**

**result += '0'**

**print(result)**

**function twoscompelment(binarynumber):**

**result = ""**

**for i from 0 to length(binarynumber)-1:**

**if binarynumber[i] == '0':**

**result += '1'**

**else if binarynumber[i] == '1':**

**result += '0'**

**carry = 1**

**twoscompelment = ''**

**for i from length(result) -1 to 0 :**

**bits = int(i) + carry**

**twoscompelment += str(bits % 2)**

**carry = bits // 2**

**if carry :**

**twoscompelment += '1'**

**twoscompelment = reverse(twoscompelment)**

**print(twoscompelment)**

**function maximum\_length (number1 , number2):**

**if length(number1) > length(number2):**

**return length(number1)**

**else if length(number1) < length(number2):**

**return length(number2)**

**else if length(number1) == length(number2) :**

**return length(number1)**

**function add\_zeroes (number1 , number2):**

**maximumlength = maximum\_length(number1 , number2)**

**number1 = zfill(number1 , maximumlength)**

**number2 = zfill(number2 , maximumlength)**

**return number1 , number2**

**function addition (number1 , number2):**

**number1 , number2 = add\_zeroes(number1 , number2)**

**result = ""**

**carry = 0**

**i = len(number1) - 1**

**while i >= 0 :**

**sum = int(number1[i]) + int(number2[i]) + carry**

**if sum == 0 :**

**result += '0'**

**carry = 0**

**else if sum == 1:**

**result += '1'**

**carry = 0**

**else if sum == 2 :**

**result += '0'**

**carry = 1**

**else if sum == 3 :**

**result += '1'**

**carry = 1**

**i -= 1**

**if carry :**

**result += '1'**

**result = reverse(result)**

**print(result)**

**function subtraction (number1 , number2):**

**number1 , number2 = add\_zeroes(number1 , number2)**

**result = ""**

**borrow = 0**

**i = len(number1) - 1**

**while i >= 0 :**

**difference = int(number1[i]) - int(number2[i]) - borrow**

**if difference == 0 :**

**result += '0'**

**borrow = 0**

**else if difference == 1:**

**result += '1'**

**borrow = 0**

**else if difference == -1 :**

**result += '1'**

**borrow = 1**

**i -= 1**

**result = reverse(result)**

**print(result)**

**menu1 = ("A" , "a" , "B" , "b")**

**menu2 = ("A", "a" , "B" , "b" , "C" , "c" , "D" , "d")**

**while True :**

**while True :**

**print("\*\*binary calculator\*\*")**

**print("A) insert new numbers")**

**print("B) Exit")**

**user\_input = input("please select an option: ")**

**if user\_input in menu1 :**

**break**

**else :**

**print("please select a valid choice")**

**if user\_input == "A" or user\_input == "a":**

**binarynumber = input("enter a new number")**

**if checkbinary(binarynumber) :**

**while True :**

**print("\*\*please select an operation\*\*")**

**print("A) compute one's complement")**

**print("B) compute two's complement")**

**print("C) addition")**

**print("D) subtraction")**

**user\_2input = input("please select an option: ")**

**if user\_2input in menu2 :**

**break**

**else :**

**print("please select a valid option")**

**if user\_2input == "A" or user\_2input == "a":**

**print(onescomplement(binarynumber))**

**else if user\_2input == "B" or user\_2input == "b":**

**print(twoscompelment(binarynumber))**

**else if user\_2input == "C" or user\_2input == "c":**

**seconedbinarynumber = input("enter the number you want to add")**

**if checkbinary(seconedbinarynumber):**

**print(addition(binarynumber , seconedbinarynumber))**

**else :**

**print ("the number you entered is not binary")**

**else if user\_2input == "D" or user\_2input == "d":**

**seconedbinarynumber = input("enter the number you want to subtract")**

**if checkbinary(seconedbinarynumber):**

**print(subtraction(binarynumber , seconedbinarynumber))**

**else :**

**print("the number you entered is not binary")**

**else:**

**print (binarynumber , "is not a binary number")**

**else if user\_input == "B" or user\_input == "b":**

**print("thank you for using binary calculator")**

**break**