BRAC University
Department of Computer Science and Engineering (CSE)

CSE230: Discrete Mathematics

SET - A

Semester: **Spring 2024**
Examination: **Quiz 5**

Time: **20 minutes**
Full marks: **20**

Name: ____________________ ID: ____________________ Section: _____

(There are 2 questions total. You must answer ***both****.*
Feel free to use the back of the question paper, if needed.)

Q1. Assume that the population of the world in 2017 was 7.6 billion and is growing at the rate of 1.12% per year.
(a) Set up a recurrence relation for the population of the world n years after 2017.
(b) Find an explicit formula for the population of the world n years after 2020.

[3+7=10 Marks]

Q2. For the following list of integers: 1, 3, 7, 13, 21, 31, 43, 57, 73, 91, …
(a) Provide a simple formula that generates the terms of this integer sequence. (a_n = ?)
(b) Using your formula for a_n, calculate $\sum_{i=10}^{14} a_i$ by evaluating the individual terms.

[7+3=10 Marks]

End

Q.1 a) Let, population in n years after 2017 is denoted by an.
$\therefore a_0 = 7.6, a_1 = 7.6 * (1.12), a_2 = 7.6 * (1.12) * (1.12)$
$\therefore a_n = a_{n-1} * (1.12)$

b) Here, $a_0 = 7.6 = 7.6 * (1.12)^0$
$a_1 = 7.6 * (1.12) = 7.6 * (1.12)^1$
$a_2 = 7.6 * (1.12) * (1.12) = 7.6 * (1.12)^2$
$a_3 = 7.6 * (1.12) * (1.12) * (1.12) = 7.6 * (1.12)^3$
. . .
$a_n = 7.6 * (1.12)^n$

let P_n be population in n years after 2020.
Population in 2020 = $P_0 = a_3$,
$\therefore P_1 = a_4 \quad \ldots \quad P_n = a_{n+3} = \boxed{7.6 * (1.12)^{n+3}}$

Q2. a)

$a_0 = 1 = 0+1 = 1+0^2$

$a_1 = 3 = 2+1 = \cancel{1+1+1} = 2+1^2$

$a_2 = 7 = \cancel{5+2 = 2+4+1}\ 3+4 = 3+2^2$

$a_3 = 13 = 4+9 = 4+3^2$

$a_4 = 21 = 5+16 = 5+4^2$

$\dots$

$a_n = n + n^2 + 1$

2.b)

$a_{10} = 10 + 10^2 + 1 = 111$

$a_{11} = 11 + 11^2 + 1 = 133$

$a_{12} = 12 + 12^2 + 1 = 157$

$a_{13} = 13 + 13^2 + 1 = 183$

$a_{14} = 14 + 14^2 + 1 = 211$

$\therefore \sum_{i=10}^{14} a_i = a_{10} + a_{11} + a_{12} + a_{13} + a_{14}$

$= 111 + 133 + 157 + 183 + 211$

$= \boxed{795}$