CMPE/CMSE-471 Assignment # 1

Last Due Time: 10/11/2020 – 16:30

Q.1) [20 pts] Given the set A={1,2,3,4} and a relation R on A such that:
R={(1,1),(1,2),(3,3),(2,1)}, find

a) The reflexive closure of R,
b) The symmetric closure of R
c) The transitive closure of R.
d) The equivalence relation of R.

Q.2) [20 pts]
Let A = {1,2,3,4,5,6} and consider the following functions from A→A:
$f(n) = n$; $g(n) = 6-n$; $h(n) = \max\{3,n\}$; and $p(n) = \max\{1,n-1\}$. Fill in the following table with **Yes/No** to indicate whether each of the above functions is *Total*, *onto*, *one-to-one*, and *bijection* or not.

Function	**Total?**	**Onto?**	**One-to-one?**	**Bijection?**
$f(n) = n$				
$g(n) = 6-n$				
$h(n) = \max\{3,n\}$				
$p(n) = \max\{1,n-1\}$				

Q.3)[20 pts] Prove by induction that

$$\sum_{i=1}^{n} i^3 = \frac{n^2(n+1)^2}{4} \qquad (n = 1, 2, 3, \dots\dots)$$

Q.4)[20 pts]

Consider the CFG grammar $G = (\{S,A\}, \{a,b,c,d\}, P, S)$ where P consists of the following productions:

$$S \rightarrow aSd \mid A$$
$$A \rightarrow bAc \mid \varepsilon$$

Using set notation, describe the language generated by the above grammar.

Q.5)[20 pts]

Consider the CFL language L = $\{ a^n b^m a^n \mid n,m \geq 1\}$.
Give a CFG grammar that generates L.