



**Assignment #2 - CPCS 222 (Winter 2022-23)**  
**(Boy's campus)**

**Due: Wednesday (01/02/2023)**

Student Name : \_\_\_\_\_ Student ID: \_\_\_\_\_

Section : \_\_\_\_\_

**1. Sets**

a) Let  $A = \{1, a, b\}$ ,  $B = \{p, 2\}$  and  $C = \{r, \{\emptyset\}\}$ . Find

i.  $R = C \times B \times A =$

ii.  $|R| + |A \times B| + |P(A)| =$

b) Let  $A = \{7, 3, 7, 1, 4, 6, 2, 9\}$  and  $B = \{1, 2, 5, 4, 3, 3\}$  and  
 $C = \{x \mid 2 \leq x \leq 5\}$ .  $U = \{x \mid 0 \leq x \leq 9\}$  Find

i.  $(A \cup \bar{B}) \cap (A - C)$

ii. Draw the Venn diagrams of  $(B \cap \bar{A}) \cup C$  and  $B \subseteq U$

**2. Summations**

a)  $\sum_{x=1}^{15} (3x^2 + 4x)$

b)  $\sum_{i=n-6}^n \sum_{j=1}^n (2i + 6j^2)$



3. **Sequences** – Write the 10<sup>th</sup> term of the following sequences

a) 2.4, 3.6, 4.8, 6.0, 7.2, .....

b)  $\frac{1}{16}j^{-4}, -\frac{1}{8}j^{-3}, \frac{1}{4}j^{-2}, -\frac{1}{2}j^{-1}, 1, \dots$

4. **Functions**

a) Determine whether the function  $f(x) = -2x + 5$  is a bijection from  $\mathcal{R}$  to  $\mathcal{R}$

b)  $\lfloor (\lceil \pi \rceil + \lfloor (1.4)^2 \rfloor) \rfloor =$

c) Write the property of inverse function.

d) If  $f(x) = -2x + 5$  and  $g(x) = 3x^2 - 4$ , find

i)  $f \circ g(x) =$   ii)  $g \circ f(-1) =$

5. **Relations**

a) For the following relations on the set  $\{1, 2, 3, 4\}$  decide whether it is reflexive, irreflexive, symmetric, anti-symmetric, transitive and equivalence

i.  $\{(2,2), (1,2), (3,3), (3, 2), (4,4)\} -$

ii.  $\{(1, 1), (1, 2), (2, 1), (2, 2), (3, 3), (4, 4)\} -$

iii.  $\{(1, 1), (1, 2), (2, 1), (2, 3), (3, 3), (3, 4), (4, 4)\} -$

b) Convert all the relations given above in 5a to matrix format.

c) Draw the directed graph that represents the relation  $\{(a, a), (a, b), (b, d), (c, b), (c, d), (d, a), (d, b), (d, d)\}$ .



## Counting

- a) What is the value of K and R after the following codes have been executed? (i)  
K=\_\_\_\_\_

```
K:=0
for i1:=1 to n
    K:= K +1
for i2=1 to 2n
    K:= K +1
for i3=1 to 3n
    K:= K +1
```

ii)

```
R:=0
for i1:=1 to n
    for i2:=1 to 2n
        for i3:=1 to 3n
            R:= R +1
```

R=\_\_\_\_\_

- b) A student taking a mathematics exam is directed to answer any seven of 10 easy questions. How many ways are there to answer these questions?
- c) How many ways are there to select 12 countries in the United Nations to serve on a council if 3 are selected from a block of 45, 4 are selected from a block of 57, and the others are selected from the remaining 69 countries?
- d) How many ways are there to arrange the letters a, b, c, and d such that a is not followed immediately by b?
- e) How many strings of eight uppercase English letters are there.
- i) If no letter can be repeated
- ii) The start and end can be repeated.
- f) A bowl contains 10 red balls and 10 blue balls. How many balls should we select at random without looking at them to definitely get
- i) 5 balls of the same color?
- ii) 4 blue balls?



- g) A computer company receives 350 applications from computer graduates for a job. Suppose that 220 of these people majored in CS, 147 majored in business, and 51 majored both in CS and in business. How many of these applicants will be rejected from these 350 applications?
- h) What is the minimum number of students needed in a class to be sure that at least 5 born on the same month?
- i) How many strings of nine English letters are there such that it contains at least three vowels (a, e, i, o, u)?

### Induction

Let  $P(n)$  be the statement that  $\sum_{i=1}^n (i - 2)(i + 2) = \frac{n(n+1)(2n+1)}{6} - 4n$

- a) Show that  $P(1)$  is true.
- b) What is the inductive hypothesis?
- c) Prove the statement given above for all values of  $n$  using mathematical induction.