**FPT University**

**Course: Discrete mathematics**

**Course ID: MAD101**

**Student’s name: Group:**

**EXERCISES - CHAPTER 2**

**PART I (7 MARKS)**

1. Determine whether each of these statements is true or false.
2. 0 ∈ ∅
3. ∅ ∈ {∅}
4. x ∈{x}
5. ∅ ∈ {x}
6. ∅ ⊆ {x}
7. Find the power set of each of these sets.
8. ∅
9. {∅}
10. {a, {a}}
11. Let A = {Floor 1, Floor 2, Floor 3} and B = {Office 1, Office 2}. Find A × B.
12. What is the **cardinality** of each of these sets?
13. ∅
14. {∅}
15. {{{a}, a}}
16. {∅, a}
17. Suppose that A is the set of sophomores at your school and B is the set of students in discrete mathematics at your school. Express each of these sets in terms of A and B.
18. the set of sophomores taking discrete mathematics in your school.
19. the set of sophomores at your school who are not taking discrete mathematics.
20. the set of students at your school who either are sophomores or are taking discrete mathematics .
21. the set of students at your school who either are not sophomores or are not taking discrete mathematics.
22. Suppose that the universal set is U ={1, 2, 3, 4, 5, 6, 7, 8, 9, 10}. Express each of these sets with bit strings where the ith bit in the string is 1 if i is in the set and 0 otherwise.
23. {1, 4, 5}
24. {2, 3, 6, 10}
25. {2, 3, 5, 7, 8, 9}
26. Suppose that the **universal set** is U = {1, 2, 3, 4, 5, 6, 7, 8, 9, 10}. Find the set speciﬁed by each of these bit strings.
27. 11 0100 1011
28. 01 0011 1000
29. 10 1001 0001
30. Determine whether the rule describes a **function** with the given **domain** and **codomain.**
31. *f*  **N**  **N** where 
32. *h*  **R**  **R** where 
33. *F*  **R**  **R** where 
34. *F*  **Z**  **R** where 
35. *F*  **Z**  **Z** where 
36. *G*  **R**  **R** where 
37. Determine whether each of these functions from {a, b, c, d} to itself is **one-to-one**.
38. f(a) = b, f(b) = a, f(c) = c, f(d) = d
39. f(a) = b, f(b) = b, f(c) = d, f(d) = c
40. f(a) = d, f(b) = b, f(c) = c, f(d) = d
41. Determine whether each of these functions from {a, b, c, d} to itself is **onto**.
42. f(a) = b, f(b) = a, f(c) = c, f(d) = d
43. f(a) = b, f(b) = b, f(c) = d, f(d) = c
44. f(a) = d, f(b) = b, f(c) = c, f(d) = d
45. Determine whether each of these functions from {a, b, c, d} to itself is a **bijection**.
46. f(a) = b, f(b) = a, f(c) = c, f(d) = d
47. f(a) = b, f(b) = b, f(c) = d, f(d) = c
48. f(a) = d, f(b) = b, f(c) = c, f(d) = d
49. Find f ◦ g and g ◦ f , where f(x) = x2 + 1 and g(x) = x + 2, are functions from R to R.
50. Suppose *g*  *A*  *B* and *f*  *B*  *C* where *A*  *B*  *C*  1234, *g*  (14)(21)(31)(42) and *f*  (13)(22)(34)(42).
51. Find *f*  *g*.
52. Find *g*  *f*.
53. Find *g*  *g*.
54. Suppose *g*  *A*  *B* and *f*  *B*  *C* where *A*  1234, *B*  *a**b**c*, *C*  2810, and *g* and *f* are defined by *g*  (1*b*)(2*a*)(3*b*)(4*a*) and *f*  (*a*8)(*b*10)(*c*2).
55. Find *f*  *g*.
56. Find *f*1.
57. Find *f*  *f*1.
58. What are the values of these sums, where S ={1, 3, 5, 7}?
59. Compute each of these double sums.

**PART II (3 MARKS)**

1. Suppose *A*  *a**b**c* and *B*  *b**c*. Mark the statement TRUE or FALSE.
2. |*P*(*A*  *B*)   64.
3. *B*  *A*.
4. *c*  *B*
5. *a**b*  *A*  *A*.
6. *b**c*  *P*(*B*).
7. *c*  *P*(*B*).
8. Determine whether f is a function from the set of all bit strings to the set of integers if
9. f(S) is the position of a 0 bit in S.
10. f(S) is the number of 1 bits in S.
11. Let A and B be sets. Show that
12. (A ∩ B) ⊆ A.
13. A ⊆ (A ∪ B)
14. A − B ⊆ A
15. A − B = A ∩
16. B ∪ (A − B) = A ∪ B
17. Determine whether the function f : Z × Z → Z is **onto** if
18. f (m, n) = m - n.
19. f (m, n) = m2 + n2.
20. f (m, n) = m.
21. f (m, n) =|n|.
22. Compute each of these sums.