



**Final Exam 2020-2021**  
**Discrete Mathematics BS – 103**

الامتحان يقع في صفتين

**First Question (20-Marks)**

① Choose the correct sign “✓ or ✗” for the followings:

- [1] If  $a, b \in D_f$  such that  $a < b$ , then  $f$  is increasing function if  $f(a) < f(b)$  (~~✓~~ ...)
- [2] The series  $3 + 0.3 + 0.03 + \dots$  is convergent (... ..)
- [3] A tree with 3 -vertices has exactly 3 edges (~~✓~~ ...)
- [4]  $\sum_{k=1}^{n-1} a_{k-1} a_{n-k} = \sum_{k=3}^{4-n} a_{3-k} a_{n+k-4}$  (~~✓~~ ...)
- [5] If  $R_2 = R \cup R^{-1}$ , then  $R_2$  should be symmetric (~~✓~~ ...)
- [6] If  $f(x) = \lceil x + 1 \rceil$ , then  $12 \bmod 4 - 0.5 f(-1.5)$  equals 0 (~~✓~~ ...)
- [7] The function  $f(x) = \frac{x^2-x-6}{x^2-9}$  have a horizontal asymptote line:  $y = 1$  (... ..)
- [8] The hash function  $h(x)$  is one to one because  $h(137) = h(258)$  (... ✗ ...)
- [9]  $(12 \bmod 5) + h(15) - 3[-4.7] + 2[0.3] = 32$  (... ✗ ...)
- [10] The general term of the sequence: 6, 0.6, 0.06, ... is  $\left(\frac{6}{10^n}\right)$  for  $n \geq 1$  (~~✓~~ ...)

② Choose the correct answer for the following statements:

- [1] The function  $f(x) = -x^3 + 2x$  is..... { odd ; even ; neither odd nor even }
- [2] The total number of terms in the expansion  $(2x + 3y + 4z)^{15}$  is... { 680 ; 136 ; 455 }
- [3]  $3 \lceil 1.8 \rceil + 2 \lfloor -1.1 \rfloor = \dots$  { 4 ; 10 ; 2 }
- [4] The Fibonacci sequence  $f_n = f_{n-1} + f_{n-2}$  is of order ... { 0 ; 1 ; 2 }
- [5] The coefficient of the term involves  $x^2 y^3 z^5$  in  $(x + y + z)^{10}$  is { 455 ; 66 ; 2520 }
- [6] The vertical asymptote lines of function  $f(x) = \frac{x^2-x-6}{x^2-9}$  are:  $x = \dots$  { 3 ; -3 ; ±3 }
- [7] The domain of the function  $f(x) = e^x$  is... {  $\mathbb{R}^-$  ;  $\mathbb{R}$  ;  $\mathbb{R}^+$  }
- [8] The quantity  $h(137) + 12 \bmod 5 - [-1]$  equals... { 6 ; 8 ; 7 }
- [9] The range of the function  $f(x) = -2 \sin(3x - 1) - 2$  is... {  $[0, 4]$  ;  $[-4, 4]$  ;  $[-4, 0]$  }
- [10] The identity function  $f(x) = x$  is ... { Onto ; one to one ; Bijective }



### Second Question (30-Marks)

- 1 Find the vertical and horizontal asymptote lines and then graph the function:  $f(x) = \frac{1}{x-2}$

- Express the function  $f(x) = \begin{cases} -t & 0 < t \leq 1 \\ t & 1 < t \leq 2 \\ t^2 & 2 < t \leq 3 \end{cases}$  in terms of unit step functions.

$$4(t-0)4(t-2)d3$$

- ③ Change the lower index of the sum  $\sum_{k=1}^n a_{n-k}$  to start with  $k = 0$ .

### Second Question (30-Marks)

1. Construct the tree of the following expressions:  $((2 \times x) + (3 - (4 \times x))) + (x - (3 \times 11))$ , and then find the height of the tree.

$$(053) \leq (1513) \leq (2529)$$

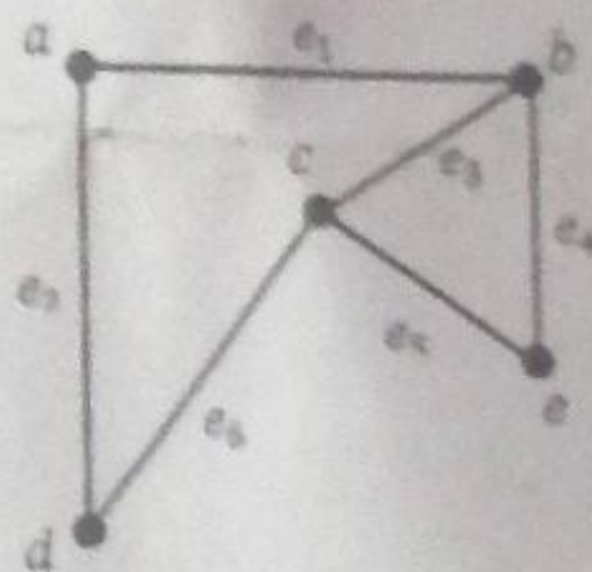
- ② Use Maclaurin series to approximate the function  $f(x) = \sin(2x) + \cos(2x)$  to just four terms and then use this to approximate the value  $f(0.1)$ .

- ③ From the opposite diagram, complete:

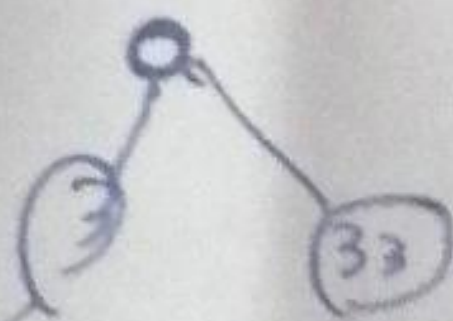
- (1) The adjacency matrix is  $A =$

- (2) The Laplacian matrix is  $L =$

- (3) The incident matrix is  $I =$



(انتهت الأسئلة)



لجنة الممتحنين:

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a b e d e  
59 0 15 0 1 0  
1 0 1 0 1  
a(+1)d(+1)c  
d  
e

a  
b  
c  
d  
e

e<sub>1</sub> e<sub>2</sub> e<sub>3</sub> e<sub>4</sub> e<sub>5</sub> e<sub>6</sub>