



Final Exam 2020-2021
Discrete Mathematics BS - 103

الامتحان يقع في صفحتين

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] $\sum_{k=1}^{k=n+1} a_{k-1} a_{n-k} = \sum_{k=3}^{k=4-n} a_{3-k} a_{n+k-4}$ (.....)
- [5] If $R_2 = R \cup R^{-1}$, then R_2 should be symmetric (✓....)
- [6] If $f(x) = [x + 1]$, 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: $6, 0.6, 0.06, \dots$ 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 } (odd)
- [2] The total number of terms in the expansion $(2x + 3y + 4z)^{15}$ is... { 680 ; 136 ; 455 } (136)
- [3] $3[1.8] + 2[-1.1] = \dots$ { 4 ; 10 ; 2 } (2)
- [4] The Fibonacci sequence $f_n = f_{n-1} + f_{n-2}$ is of order ... { 0 ; 1 ; 2 } (2)
- [5] The coefficient of the term involves $x^2 y^3 z^5$ in $(x + y + z)^{10}$ is { 455 ; 66 ; 2520 } (2520)
- [6] The vertical asymptote lines of function $f(x) = \frac{x^2 - x - 6}{x^2 - 9}$ are: $x = \dots$ { 3 ; -3 ; ±3 } (-3)
- [7] The domain of the function $f(x) = e^x$ is... { \mathbb{R}^- ; \mathbb{R} ; \mathbb{R}^+ } (\mathbb{R})
- [8] The quantity $h(137) + 12 \bmod 5 - [-1]$ equals... { 6 ; 8 ; 7 } (7)
- [9] The range of the function $f(x) = -2 \sin(3x - 1) - 2$ is... {[0, 4] ; [-4, 4] ; [-4, 0]} ([-4, 0])
- [10] The identity function $f(x) = x$ is ... { Onto ; one to one ; Bijective } (Bijective)

$\mathbb{R} \rightarrow \mathbb{R}$

Second Question (30-Marks)

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

- 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.

$$u(+-\infty) u(t-2) d_3$$

- 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 expression: $((2 \times x) + (3 - (4 \times x))) \rightarrow (x - (3 \times 11))$, and then find the height of the tree.

$$(5 \times 3) \leftarrow (1 \times 13) \leftarrow (2 \times 29)$$

$$\begin{aligned} & 3 \cdot 0 \rightarrow 3 \\ & ((2 \times x) + (3 - (4 \times x))) \rightarrow (x - (3 \times 11)) \\ & 2x + 3 - 4x^2 - 3 \\ & (3 - 2x) \rightarrow -14x \end{aligned}$$

- 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 $f(0.1)$.

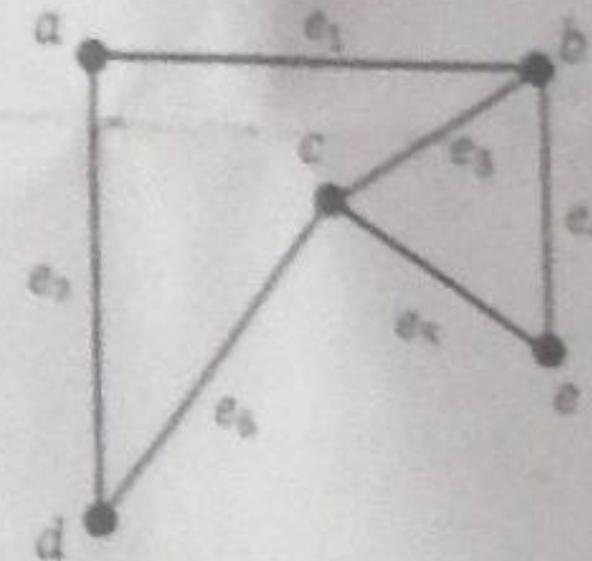
- ③ From the opposite diagram, complete:

(1) The adjacency matrix is $A =$

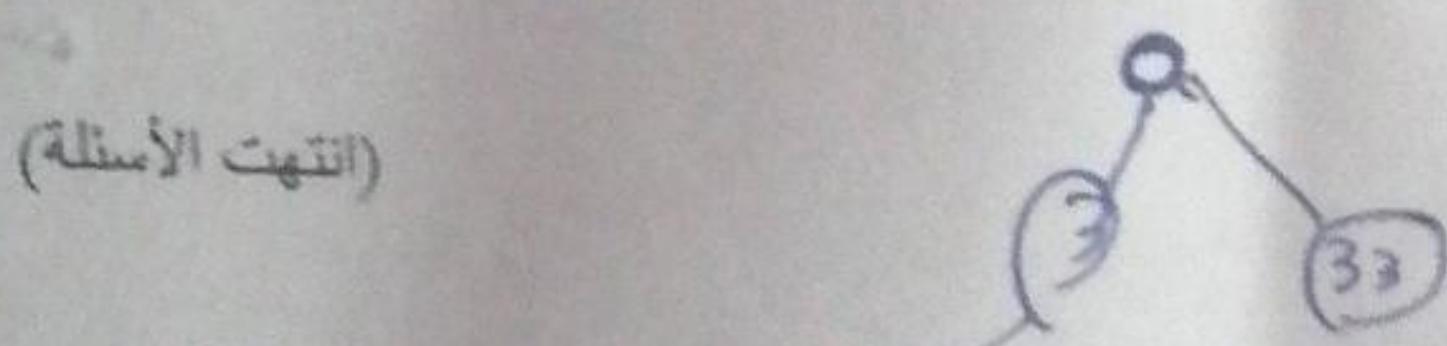
$$3-16X$$

(2) The Laplacian matrix is $L =$

(3) The incident matrix is $I =$



(انتهت الأسئلة)



$$\begin{array}{ccccccccc} & a & b & c & d & e & & & \\ & 0 & 1 & 0 & 0 & 0 & & & \\ \xrightarrow{50} & 1 & 0 & 1 & 0 & 1 & & & \\ & \text{d}(+)c & & & & & & & \end{array}$$

لجنة الممتحنين:

- (1) أ. د.م / ياسر محمد عبد العستار
- (2) أ. د. / حلمي مهران
- (3) أ. د.م / عبد المنعم مجاهد
- (4) أ. مصطفى عبد العزيز
- (5) د. أسماء عوض

$$e_1 \quad e_2 \quad e_3 \quad e_4 \quad e_5 \quad e_6$$

