Suez Canal University
Faculty of Computers & Informatics
First Semester; First Level
Date: 13-1-2019; Time: 3- Hours

جامعة قناة السويس
SUEZ CANAL UNIVERSITY

Final Examination of Discrete Mathematics BS - 103

الإمتحان يقع فى ورقة من صفحتين.

First Question (20- Marks)

Fill the circle with the appropriate signs "✓ for the circle A" or "× for the circle B "

[1] The day of the week will it be after 100 days from Saturday is **Monday**. (.....)

[2] If $R_2 = R \cup R^{-1}$, then R_2 should be **symmetric.** (.....)

[3] If $x \bmod y = r$, then y **divides** $x - r$ (.....)

[4] $0 \bmod 7 = 1$ (.....)

[5] The functions $f(x) = \lceil x \rceil$ and $f(x) = \lfloor x \rfloor$ map from $\mathcal{R}$ to z is **one to one.** (.....)

[6] The **horizontal** asymptotes of the function $y = 1/x$ is the line $y = 1$. (.....)

[7] The **Big** $\mathcal{O}$ notation is used to give an upper bound of the running time of an algorithm. (.....)

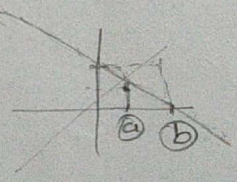
[8] If $f: R \to R^+$, $f(x) = \sin(x^2)$, then f is **one to one** function. (.....)

[9] If $f: R^+ \to R$, $f(x) = \text{Log}(x)$, then f is **onto** function. (.....)

[10] The **domain** of the function $f(x) = 2\cos(x)$ is R. (.....)

[11] The **range** of the function $f(x) = 3\sin(2x - 1) - 3$ is $[-3, 3]$. (.....)

[12] The **vertical asymptotes** of the function $y = \frac{1}{x-1}$ is the **line** $x = 0$. (.....)



[13] If $a, b \in D_f$, $a < b$, and $f(a) < f(b)$, then f is **increasing** function. (.....)

[14] If $f(x) = x$ is the **identity function**, then $f^{-1}(x) = x$. (.....)

[15] The infinite series $\frac{2}{10} + \frac{2}{10^2} + \cdots + \frac{2}{10^n} + ..$ is **divergent.** (.....)

[16] $\lfloor x \rfloor = \lceil x \rceil - 1$ for all $x \in z^+$. (.....)

[17] **Big** $\mathcal{O}$ **notation** is used to describe how closely a series approximates a given function. (.....)

[18] The **general term** of the sequence: -1, -3, -5, … is of the form: $(1 - 2n)$. (.....)

[19] If the function $f(x)$ have an **inverse**, then $(f \circ f^{-1})(x)$ should equals $1/x$ (.....)

[20] The **number of ways** for a number of two digits that can be formed from $\{1, 2, 3, 8\}$ without repeating is 16. (.....)

ملحوظة

السؤال الأول والثانى يتم إجابتة فى الجزء اليمين فى النموذج الإلكترونى للإجابة بنفس التسلسل من 1-30 فى حين أن السؤال الثالث يتم إجابتة فى كراسة الإجابة العادية.

Second Question (10- Marks)

Choose the correct answer where the first choice represents *A* and the second is *B* and so on…

[21] The infinite series $\frac{2}{10^0}+\frac{2}{10^1}+\cdots+\frac{2}{10^n}+..$ is {geometric, arithmetic}

[22] The general term of the sequence: $-1,-3,-5,-7,\ldots$ is $\{1-2n,-2n,1-n\}$

[23] $-10 \bmod 3 + 10 \bmod 3 = \cdots$ {3,-3, 0}

[24] The infinite series $3+\frac{3}{4}+\cdots+\frac{3}{4^n}+..$ is {divergent, convergent}

[25] If $f(x): \mathcal{R} \to \mathcal{R}^+: x \to e^x$ the f is {Onto, Bijective}

[26] $2\lfloor -2.5 \rfloor + 3\lfloor 2.5 \rfloor = \cdots$ {2, -2, 0}

[27] The range of the function $f(x) = Log(x)$ is { R, R^+, R^-}

[28] If $f(x) = x^2 - 3x,\ x \geq 1.5$, has an inverse, then $f^{-1}(0)$ equals {3, 0, 4}

[29] If $f(x) = 2x + a$ have the inverse $f^{-1}(x) = (x+3)/2$, then a equals… {-3, 3, 2}

[30] The number of ways in which 2 persons can be selected from a group of 6 persons is: {30, 15, 20}

Third Question (50- Marks distributed as follows: 8; 7; 7; 7; 7; 7; 7).

❶ Use **Taylor series** to **approximate** the function $f(x) = \sqrt[3]{3x+1}$ to just three terms.

❷ **Prove** that: $\sinh^{-1}x = \text{Ln}\left(x+\sqrt{x^2+1}\right)$.

❸ **Show** that $f(x) = a_n x^n + a_{n-1}x^{n-1} + \cdots + a_1 x + a_0$, where $a_0, a_1, \ldots, a_n \in \mathcal{R}$ is $\mathcal{O}(x^n)$.

❹ **Express** the function $f(t)$ by the **unit step function**, where $f(t) = \begin{cases} t^2+7 & 0 \leq t < 1 \\ t^2 & 1 \leq t < 3 \\ 7 & t \geq 3 \end{cases}$.

❺ Find the **horizontal** and **vertical** asymptotes of the function and then **sketch** the graph, $f(x) = \frac{3x-9}{x-2}$.

Find the **domain** and the **range** of f.

❻ Use **mathematical induction** to prove that: $1^2+2^2+\ldots+n^2 = \frac{n(n+1)(2n+1)}{6}$, $n = 1, 2, \ldots$

❼ **Give** three **different** examples of **odd** functions and then give their plots.

(انتهت الأسئلة)

لجنة الممتحنين:

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$\frac{1}{x^2}$ $\sqrt{x}$ $\frac{-1}{x}$ =

~~$f(-x) = \sqrt{-x}$~~ $f(-x) = \frac{1}{-x} = -\frac{1}{x} = -f(x)$