Mansoura University Faculty of Science Dept. of Mathematics Database Systems		3rd year Time: 2 Hours Date: 31/12/2012 Maximum 60 Marks

Answer the following questions:

Question #1 (20 Marks)

a) State the components that constitute a typical relational database?

b) State the different types of valuable data and their characteristics?

c) What is the difference between:-

1. Database systems and File systems

2. Tuple calculus and Domain calculus

3. Table and View

4. Interoperability and Portability

d) State the characteristics of database system?

e) Define the following:

1. Primary key   2. Foreign key   3. Index   4. Metadata   5. IDL

f) State the goals of distributed system?

Question #2 (20 Marks)

a) What is the relation between databases and computer based information system?

b) State the different types of relations and give example for each one?

c) Explain (by drawing) the different types of database models?

d) State the concurrency problem and clarify how to solve this problem?

e) Draw the block diagram of:

1. Typical database system

2. Modified database management system

3. ANSI/SPARC database model

4. Database state diagram

5. Distributed database system

6. Multi database architecture

7. Database catalog

8. Partial and Full replication

Question #3 (20 Marks)

a) Give an example for hybrid table fragmentation?

b) For the following two relations, determine union, intersection, difference (R1-R2), and cartesian product?

Relation (R1)

Emp_ID	Emp_Name	Address	Birth Date
2324	Ali	Mansoura	17/11/1987
4547	Naser	Tanta	22/02/1989
6549	Sami	Cairo	12/12/1987
7653	Yaser	Sudan	10/08/1986
8975	Hany	Cairo	04/10/1981

Relation (R2)

Emp_ID	Emp_Name	Address	Birth Date
3546	Fayez	Alexandria	24/05/1988
6549	Sami	Cairo	12/12/1987
7292	Mohamed	Sinai	03/04/1989
8975	Hany	Cairo	04/10/1981
9990	Saber	Port Said	11/11/1988

c) Perform vertical fragmentation for relation (R1) and horizontal fragmentation for relation (R2)?

d) Assume that relation **(R1)** is stored on site **SITEE** and relation **(R2)** is stored on site **SITEL**, write SQL code to count the number of employers in both tables?

Mansoura University, Faculty of Science, Mathematics Department

Numerical Analysis (1) Final Exam (Math. 313) - Term 1, January 2013   Date: 27 December 2012
Third year students (Mathematics & Statistics and Computer Science)   Time Allowed: 2 hours

مــع أطيــب أمنياتــي للجميــع . **Answer the following questions . All questions carry equal marks**

Question no.1:

1-a) Prove that : **(i)** $\Delta (x)_n = n (x)_{n-1}$, where $(x)_n$ is the falling factorial polynomial.

(ii) $(x)_{-m} = \dfrac{1}{(x+m)_m}$ **(iii)** $(1+\Delta)(1-\nabla) = 1$ **(iv)** $\dfrac{\Delta}{\nabla} - \dfrac{\nabla}{\Delta} = \nabla + \Delta$

1-b) Show that any polynomial $f(x)$ of degree n can be expressed in the form $f(x) = \sum\limits_{k=0}^{n} \dfrac{\Delta^k f(0)}{k!} (x)_k$

1-c) Use the above formula in part **1-b)** to find the polynomial that takes on the following values:

n	4	5	6	7
f(n)	61	71	83	97

Question no. 2:

2-a) State and prove the Montmort's theorem.

2-b) Use part **2-a)**, or otherwise, prove that $\sum\limits_{r=1}^{\infty} r (r+1) x^{r-1} = \dfrac{2}{(1-x)^3}$.

2-c) Derive the Lagrange interpolating polynomial that interpolates the set of points $\{(x_0, y_0), (x_1, y_1), \ldots, (x_n, y_n)\}$. Write down the associated error term expression for this interpolation formula . Show also that the sum of the Lagrange basis functions is equal to 1.

Question no. 3:

3-a) The amount A of a substance remaining in a reacting system after an interval of time t in a certain chemical experiment is given by the following data:

t	2	5	8	14
A	94.8	87.9	81.3	68.7

Use the Newton interpolating polynomial to find the value of A at t = 4.

3-b) Consider the matrix $T_n = (t_{ij})_{i,j=1}^{n}$ given by: $t_{ij} = \begin{cases} 0 & \text{if } |i-j| > 1 \\ -1 & \text{if } |i-j| = 1 \\ 2 & \text{otherwise} \end{cases}$

By solving a suitable second order homogeneous difference equation show that $\det(T_n) = n+1$.

3-c) Solve the following system of equations by using the Gauss-Seidel method

$$4x + 11y - z = 33$$
$$8x - 3y + 2z = 20$$
$$6x + 3y + 12z = 35$$

(Hint: start with the initial values x = 0, y = 0 and z = 0)

END OF EXAM
With kind regards
Examiner: Prof. Dr Moawwad El-Mikkawy

Structured Programming -Math 341
Mathematics Department
Faculty of Sciences
Mansoura University
3rd Level
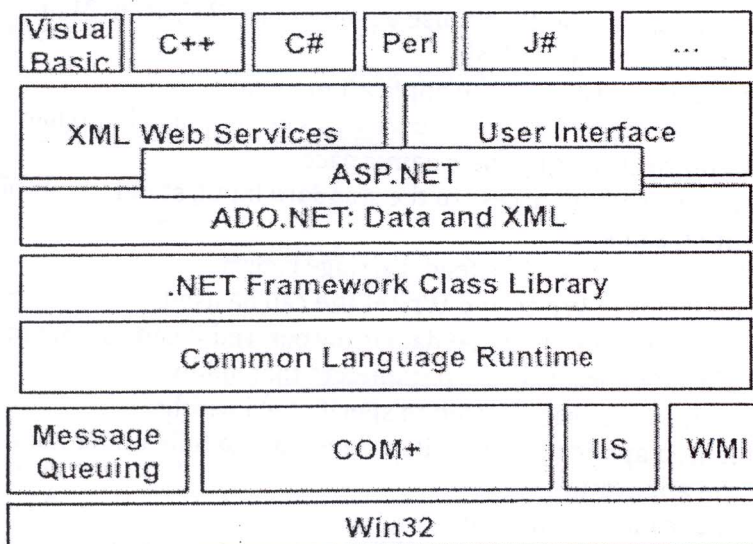Duration: 2 Hours
Date: 17th January 2013
Marks: 60 Marks

Answer All the Following Questions [8 Questions]
(Exam in four pages)

Question One [10 Marks]

The following figure presents an overview of the .Net Framework. Discuss the different components presented and their importance for developers.

Question Tow: Match the Following [10 Marks]

1. Class loader	2. Code manager	3. Garbage collector	4. Security engine	5. Debug engine
6. Type checker	7. Exception manager	8. Thread support	9. COM marshaler	10. Base Class Library

a. Integrates code with the runtime that supports the BCL.
b. Provides marshaling to and from COM.
c. Provides classes and interfaces that enable multithreaded programming.

d. Provides structured exception handling, which is integrated with Windows Structured Exception Handling (SEH).
e. Will not allow unsafe casts or uninitialized variables.
f. Allows developer to debug application and trace the execution of code.
g. Provides evidence-based security, based on the origin of the code in addition to the user.
h. Provides automatic lifetime management of all of objects.
i. Manages code execution.
j. Manages metadata, in addition to the loading and layout of classes.

Question Three: Mark as True or False [10 Marks]

1. C# application is a collection of classes, structures, and types
2. A class Is a set of data and methods
3. C# application cannot consist of many files
4. A class can span multiple files
5. The name of the application file does not need to be the same as the name of the class.
6. C# does not distinguish between definition and implementation of a class.
7. When writing Main, you should not use an uppercase "M", as in "Main"
8. Multiple classes cannot have a Main
9. When Main finishes, or returns, the application quits
10. The .NET Framework provides many utility classes organized into namespaces
11. Developers Refer to classes by their namespace
12. The Console Class Provides access to the standard input, standard output, and standard error streams.
13. Console.WriteLine outputs a line feed/carriage return
14. More powerful forms of **Write** and **WriteLine** can be used.
15. The format string specifies how the data is output, and it can contain markers, which are replaced in order by the parameters that follow.
16. format string parameter can be used to specify field widths.
17. A well-commented application permits a developer to fully understand the structure of the application
18. Block comments cannot be nested.
19. C# provides several mechanisms for adding comments to application code.
20. The .NET Platform fully supports the Internet's platform- neutral, standards-based technologies.

Question Four: [5 Marks]

Classes are the main building blocks of Object Oriented Programs, while Structs are the main building blocs of Structured Programs. Compare between Classes and Structs highlighting the main differences. In the comparison, highlight the need for Object Oriented Programming as an advance of Structured Programming.

Question Five: **[5 Marks]**

A robust C# application must be able to handle the unexpected. Illustrate the usage of try-catch in the following code example.

```
try {
        Console.WriteLine("Enter a number");
        int i = int.Parse(Console.ReadLine());
}
catch (OverflowException caught)
{
        Console.WriteLine(caught);
}
```

Question Six: Answer the following Questions   **[5 Marks]**
   1. What is the Common Type System?
   2. Can a value type be **null**?
   3. Can we use uninitialized variables in C#? Why?
   4. Can there be loss of magnitude as a result of an implicit conversion?
   5. Discuss the Different Types of Statements

Question Seven: Spot the Bugs in the following Code Examples   **[5 Marks]**

```
if number % 2 == 0    ...
```

```
if (percent < 0) || (percent > 100) ...
```

```
if (minute == 60);
    minute = 0;
```

```
switch (trumps) {
case Suit.Clubs, Suit.Spades :
    color = "Black";
case Suit.Hearts, Suit.Diamonds :
    color = "Red";
defualt :
    ...
}
```

d. Provides structured exception handling, which is integrated with Windows Structured Exception Handling (SEH).
e. Will not allow unsafe casts or uninitialized variables.
f. Allows developer to debug application and trace the execution of code.
g. Provides evidence-based security, based on the origin of the code in addition to the user.
h. Provides automatic lifetime management of all of objects.
i. Manages code execution.
j. Manages metadata, in addition to the loading and layout of classes.

Question Three: Mark as True or False   **[10 Marks]**
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Mansoura University Faculty of Science Math. Dept.		Exam: Jan. 2013 Time : 2 hours Date 21 /1/2013

<div align="center">

3rd year (stat. & Comp. Sci. and Math.)
Subject : Probability Theory

</div>

Answer the following questions: (80 Marks)

1) a- If X_1 and X_2 are independent and identically distributed according to

$$f_{X_i}(x_i) = \begin{cases} e^{-x_i} & x_i > 0, \\ 0 & O.W. \end{cases} \quad i = 1,2.$$

Find (i) the probability density function of: $Z = \ln X_1$ and $Y = X_1 / X_2$.

   (ii) $P(X_1 < X_2)$.   (20 Marks)

   b- If the joint probability function of X and Y is given by

$$f(x,y) = \begin{cases} e^{-x/y} e^{-y} / y & 0 < x < \infty, 0 < y < \infty \\ 0 & O.W. \end{cases}$$

Find the conditional expectation E(X|Y=y).   (10 Marks)

2) a- If the joint probability function of X_1 and X_2 is given by

$$f(x_1,x_2) = \begin{cases} e^{-x_1-x_2} & 0 < x_1 < \infty, 0 < x_2 < \infty \\ 0 & O.W. \end{cases}$$

Show that X_1 and X_2 are independent   (8 Marks)

b) For any two random variables X and Y , prove that

$Var(X+Y) = Var(X) + Var(Y) + 2Cov(X,Y)$.   (8 Marks)

c- If X is a random variable with mean 0 and finit variance σ^2, then for any $a > 0$

prove that : $P(X > a) \le \dfrac{\sigma^2}{\sigma^2 + a^2}$.   (9 Marks)

3) a- If X and Y are independent and contuous r. v. having probability density functions
f_X and f_Y , show that the probability density function of X+Y is given by

$$f_{X+Y}(a) = \int_{-\infty}^{\infty} f_X(a-y) f_Y(y) dy.$$ (10 Marks)

   b- If X is a random variable having the density function.

$$f(x) = \begin{cases} (1/\theta) e^{-x/\theta} & x, \theta > 0, \\ 0 & O.W. \end{cases}$$

Find i - $M_x(t)$, the moment generating function

   ii - α_3, the skewness.   (15 Marks)

Best wishes.   _Prof. Reih El-Desouky_

امتحان دور يناير ٢٠١٣ م	جامعة المنصورة – كلية العلوم
برنامج : احصاء و علوم الحاسب	قســم الرياضيات
المستوى: الثالث	التاريخ : ١٠ / ١ / ٢٠١٣ م
اسم المقرر : نظرية احصائية (١)	الدرجة الكلية : ٨٠
كود المادة : ر ٣٣٣	الزمن : ساعتان

أجب عن الأسئلة الآتية :-

السؤال الأول: أ) سحبت عينة عشوائية حجمها n من مجتمع طبيعي وسطه الحسابى μ و تباينه σ^2 . أوجد مقدري الإمكان الأكبر للمعلمين μ , σ^2 (١٥ درجة)

ب) سحبت عينة عشوائية حجمها n من توزيع وسطه الحسابى μ و تباينه σ^2 أثبت أن تباين العينة $S^2 = \frac{1}{n-1} \sum_{i=1}^{n} \left(X_i - \overline{X} \right)^2$ مقدر غير متحيز لتباين المجتمع σ^2 (١٥ درجة)

السؤال الثانى: أ) إذا كانت $X_1 , X_2 , \cdots , X_n$ عينة عشوائية من المشاهدات المستقلة المسحوبة من مجتمع طبيعى وسطه الحسابى μ و تباينه σ^2 و إذا كان $\overline{X}$ هو مقدر المعلمة μ فأوجد $I_{\overline{X}}(\mu)$ (دالة المعلومات التى يقدمها المقدر $\overline{X}$ عن المعلم μ) (١٠ درجة)

ب) أخذت عينة حجمها ٦٤ طفلا ممن هم فى عامهم الأول فوجد أن الانحراف المعيارى لأوزانهم ٨٠٠ جم فإذا كانت أوزان الأطفال فى هذا السن تخضع لتوزيع وسطه ٦ كجم . فما احتمال أن يقل الوسط الحسابى لأوزان العينة عن 6.2 كجم (١٠ درجة)

ج) احسب حجم العينة اللازم سحبها من مجتمع حجمه ٢٠٠٠٠ لتقدير المتوسط لظاهرة معينة بخطأ لا يتعدى ٢ بدرجة ثقة ٩٥ % بفرض أن تباين تلك الظاهرة فى المجتمع ١٦٠٠ (١٠ درجة)

السؤال الثالث: أ) إذا كانت دالة كثافة احتمال المتغير X هى $f(x; \beta) = \beta\, x^{\beta-1}$ حيث $\beta > 0$, $0 < x < 1$ قدر β بطريقة العزوم . (١٠ درجة)

ب) سحبت عينة عشوائية بسيطة مكونة من ١٠ أفدنة من منطقة بها ٦٠٠٠ فدان مزروعة قمحا فكان إنتاج تلك الأفدنة بالكجم كالآتى 890 , 880 , 870 , 930 , 800 , 920 , 800 , 900 , 960 , 100

١) احسب ٩٩ % فترة ثقة لمتوسط انتاجية الفدان من القمح بتلك المنطقة. (٨ درجات)

٢) احسب ٩٩ % فترة ثقة لإجمالى الانتاج من القمح بتلك المنطقة. (٢ درجة)

$$\varphi(0.02) = 0.5080 \quad , \quad \varphi(2) = 0.9772 \quad , \quad t_{(0.005,\,9)} = 3.250 \quad , \quad t_{(0.005,\,10)} = 3.169$$

$$Z_{0.005} = 2.58 \quad , \quad Z_{0.025} = 1.96 \quad , \quad t_{(0.025,\,9)} = 2.262 \quad , \quad t_{(0.025,\,10)} = 2.228$$

مع التمنيات بالنجاح

د. فاتن شيحه

Final Exam- Semester I - Year 2012/2013

SUBJECT: *Measure Theory* *(MATH 311)* Level-3	Faculty of Science Mathematics Department	**DATE:** 3/ 1 / 2013 **FULL MARK:** *80* **ALLOWED TIME:** *2Hours*

Answer the following questions

Question-1

1. Prove that, if $\mu: \Omega \rightarrow [0,\infty)$, $A, B \in \Omega$ and $\mu(A \cap B) < \infty$, then $\mu(A \cup B) = \mu(A) + \mu(B) - \mu(A \cap B)$

1. Define the outer measure on an algebra Ω, and prove that If A is countable , then $\mu^{*}(A) = 0$

Question-2

1. Define the measurable set, and prove that a set consisting one point is measurable and its measure is zero
2. Prove that if $\mu^{*}(E) = 0$, then E is measurable

Question-3

1. Define the measurable function, and prove that every continuous function is measurable
2. Prove that if f_1 and f_2 are measurable on [a,b] then so are $f_1 + f_2, f_1 \cdot f_2$ and $Max\{f_1, f_2\}$

Question-4

Show that the function

$$f(x) = \begin{cases} 1, \ x \ is \ a \ rational \ number \ in [0,1] \\ 0, \ x \ is \ an \ irrational \ number \ in [0,1] \end{cases}$$

1. Is not Riemann integrable in [0,1]
2. Is Lebesgue integrable in [0,1] and find the value of Lebesgue integral of f(x) in [0,1]

Mansoura University
Faculty of Science
Mathematics Department
Statistics and Computer Science Program
3rd Year, First Term 2012/2013

Jan. 14th, 2013
Course: Selected Topics
Time Allowed: 2 Hours
Total Marks: 60 Marks
Examiner: Dr. Osama Ouda

Final Exam

Question #1 (20 marks)

(a) For the following alignment:

```
--TCATAC-TCATGAACT
GGTAATCCCTC---AA--
```

Calculate the score, if:

  i.   Match = 1, mismatch = -1, indel = -1
  ii. Match = 1, mismatch = -1, initial gap = -2, each space = -1

(b) For the following DNA sequences:

$$S:\ \text{ATGCGT}$$
$$R:\ \text{ACGGCGT}$$

  i.   Obtain the optimal global alignment using the *Needleman-Wunsch* algorithm.
  ii. Find the best local alignment between **S** and **R** using the *Smith-Waterman* algorithm.

Question #2 (20 marks)

(a) Given a 3D point in homogeneous coordinates $X = \begin{bmatrix} 0 & 4 & 4 & 2 \end{bmatrix}^T$, and the following 3×4 camera matrix:

$$P = \begin{bmatrix} 5 & -14 & 2 & 17 \\ -10 & -5 & -10 & 50 \\ 10 & 2 & -11 & 19 \end{bmatrix}$$

  i.   What are the Cartesian coordinates of the point X in 3D?
  ii. What are the Cartesian image coordinates, (u, v), of the projection of X?

(b) Show how P can be decomposed into a product of matrices that contain elements expressed in terms of the intrinsic and extrinsic camera parameters.

(c) A scene point at coordinates (400, 600, 1200) is perspectively projected into an image at coordinates (24, 36), where both coordinates are given in millimeters in the camera coordinate frame, and the camera's principal point is at coordinates (0, 0, f). Assuming the aspect ratio of the pixels in the camera is 1, what is the focal length of the camera?

Question #3 (20 marks)

(a) Perform the conversions between RGB and HSV color spaces, for the following values (and justify your answer):

R	G	B	H	S	V
0.3	0.3	0.7			
0.7	0.9	0			
			0	0	1
			0.5	1	1

(b) For the following image, find the gray-level co-occurrence matrix for $d = (1, 1)$, then compute the entropy, contrast, and homogeneity texture features:

2	1	2	0	1
0	2	1	1	2
0	1	2	2	0
1	2	2	0	1
2	0	1	0	1

(c) For the following image (left) and filter (right), answer the following:

150	152	148	149
147	152	151	150
152	148	149	151
151	149	150	148

$$\begin{bmatrix} 1 & -2 & 1 \\ -2 & 4 & -2 \\ 1 & -2 & 1 \end{bmatrix}$$

   i.   Apply the filter to the central four elements of the image.
  ii.   Is the above filter separable? If yes, show how to perform convolution required in (i) in a more efficient way.