Answer all the following Questions

Question:1			(25 marks)

(a) If it is possible, solve the following mathematical models **by using graphical method**

(i)
$$\text{Minimize} \quad Z = x_1 + 4x_2$$
$$\text{subject to} \quad x_1 + 2x_2 \leq 8,$$
$$2x_1 + x_2 \geq 4,$$
$$x_1, x_2 \geq 0.$$

(ii)
$$\text{Maximize} \quad Z = 4x_1 + x_2$$
$$\text{subject to} \quad 3x_1 + x_2 \leq 6,$$
$$x_1 - x_2 \geq 2.$$
$$x_1, x_2 \geq 0.$$

(iii)
$$\text{Maximize} \quad Z = x_1 + 5x_2$$
$$\text{subject to} \quad 3x_1 + 2x_2 \leq 6,$$
$$x_2 \geq 1,$$
$$x_1 + x_2 \geq 1,$$
$$x_1, x_2 \geq 0.$$

(iv)
$$\text{Minimize} \quad Z = x_1 + 5x_2$$
$$\text{subject to} \quad 2x_1 + x_2 \leq 8,$$
$$x_1 + x_2 \geq 4,$$
$$x_1 \leq 3,$$
$$x_1; x_2 \geq 0.$$

(b) Express the following linear programming problem in **the standard form:**

$$\text{Minimize} \quad Z = 3x_1 + x_2 + 15x_3$$
$$\text{subject to} \quad 2x_1 + x_2 - x_3 \leq 4,$$
$$4x_1 - x_2 + 2x_3 \leq -5,$$
$$3x_1 - x_2 + x_3 \geq 3,$$
$$x_2, x_3 \geq 0.$$

Question:2			(20 marks)

(a) Use **The Simplex method** to solve the following linear programming problem

$$\text{Maximize} \quad Z = 3x_1 + 4x_2$$
$$\text{subject to} \quad x_1 + x_2 \leq 3,$$
$$2x_1 + x_2 \leq 4,$$
$$x_1, x_2 \geq 0.$$

	(b)	Use **_Two Phase method_** to solve

$$\text{Maximiz} \quad Z = 5x_1 + 3x_2$$
$$\text{subject to} \quad x_1 + x_2 \leq 1,$$
$$x_1 - x_2 \geq 6,$$
$$x_1, x_2 \geq 0.$$

Question:3   (20 marks)

(a) *Find the initial basic feasible solution to the following transportation problem by:*

(i) *minimum cost method,*

(ii) *north-west corner rule,*

(iii) *Vogel's approximation method*

		To					
		M_1	M_2	M_3	M_4	M_5	supply
from	S_1	17	4	8	7	2	60
	S_2	13	5	16	12	0	30
	S_3	10	10	14	11	6	20
	S_4	3	9	19	8	18	40
Demand		40	25	35	30	20	

Question:4   (15 marks)

Solve the following Assignment problem:

	I	II	III	IV	V
1	8	3	7	16	9
2	9	5	2	8	10
3	7	2	8	4	1
4	18	9	6	17	15
5	9	4	12	11	8

GOOD LUCK

Mansoura University
College of Science
Dept. of Math..

Final Exam: stochastic process
First Semester, 2013 G
Time allowed is 2 hours

Answer the following questions:

Q.1

  a. Define the following concepts:
  1. Markov chain-Recurrent, transient and absorbing states of a Markov chain.
  2. Stationary distribution of a Markov chain.
  3. Transition probability matrix-Irreducible Markov chain.

  b. A defective coin, with $P(H) = \dfrac{1}{3}$ and $P(T) = \dfrac{2}{3}$ is tossed 10 times. Let X_n

  denote the total number of heads H which appear up to the n-th toss.   Prove that

  $\{X_n, n = 1,2,3,....\}$ is a Markov chain and determine the state   space and parameter
  space.

Q.2

1. A Markov chain with t.p.m

$$\begin{bmatrix} 1-\alpha & \alpha \\ \beta & 1-\beta \end{bmatrix}$$

where $0 < \alpha < 1, 0 < \beta < 1$

    a. Find the transition matrix of n step.
    b. Find $\lim_{n \to \infty} P^n$.

2. Find the stationary distribution of the Markov chain with the following t.p. m

$$\begin{bmatrix} \dfrac{1}{2} & \dfrac{1}{3} & \dfrac{1}{6} \\ \dfrac{1}{4} & \dfrac{1}{2} & \dfrac{1}{4} \\ \dfrac{1}{6} & \dfrac{1}{3} & \dfrac{1}{2} \end{bmatrix}$$

3. A Markov chain has the following t.p.m

$$\begin{bmatrix} 1 & 0 & 0 & 0 \\ 0 & \dfrac{1}{4} & \dfrac{3}{4} & 0 \\ 0 & \dfrac{1}{6} & \dfrac{5}{6} & 0 \\ \dfrac{3}{4} & 0 & 0 & \dfrac{1}{4} \end{bmatrix}$$

Determine the classes of the Markov chain and classify the states into recurrent and transient states.

Q.3

1. Define the Poisson Process.
2. Suppose that telephone calls arrive at random a telephone exchange at the rate 15 calls per hour minute.
    a. Find the probability that at least 2 telephone calls between 8 and 8.12 am.
    b. If the operator is absent for 10 minute, find the probability that no calls will be missed.

← انظر خلف الورقة ، لوجود

3. Suppose that events occur according to the Poisson process with constant rate λ. If the first event occurs after time T, prove that the random variable T has exponential distribution with mean $\dfrac{1}{\lambda}$.

4. Suppose that earthquakes occur at random in a certain place at the rate 2 per year. If an earthquake has just occurred, find the probability that it will be at least 3 years before the next earthquake occurs.

Q.4

a. Assume that $P_n(t) = P\{X(t) = n \mid X(0) = 0\}$ and $X(t)$ is the number of times an event occurs in the time interval $(0,t)$. Suppose that the event occurs under the following conditions:

1. Births which occur in disjoint intervals are independent of each other.
2. When there n members in the population at time t
   - $P\{one\ event\ in\ (t,t+\delta t)\} = \lambda_n\,\delta t + o(\delta t)$,
   - $P\{two\ or\ more\ events\ in\ (t,t+\delta t)\} = o(\delta t)$,

   Let $P_n(t)$ denote the probability that the population size at time t is n, prove that

   $$\frac{dP_n(t)}{dt} + \lambda_n P_n(t) = \lambda_{n-1}P_{n-1}(t), \quad n \geq 1$$

   $$\frac{dP_0(t)}{dt} = -\lambda P_0(t)$$

b. For linear birth process $\lambda_n = n\lambda$, and the condition

   $$P_n(0) = \begin{cases} 1 & if\ n=i \\ 0 & if\ n \neq i \end{cases}$$

prove that

   $$P_n(t) = e^{-\lambda t}(1 - e^{-\lambda t})^{n-1}, \quad n \geq 1$$

   where $P_n(t) = P\{X(t) = n \mid X(0) = 0\}$.

c. Consider a Birth and Death process $\{P_n(t) = P(X(t) = n \mid X(0) = 0)$. Prove that:

   $$\frac{dP_n(t)}{dt} = -(\mu_n + \lambda_n)P_n(t) + \mu_{n+1}P_{n+1}(t) + \lambda_{n-1}P_{n-1}(t), \quad n \geq 1.$$

Mansoura University Faculty of Science Dept. of Mathematics Neural Networks		4th year Time: 2 Hours Date: 1/1/2014 Maximum 60 Marks

Answer the following questions:

Question #1 [20 Marks]

a) What are the main factors that characterize neural networks?

b) State the main advantages of neural networks?

c) What is the difference between:

1. Action potential and activation function   2. Feedforward and feedback neural networks?

3. Supervised and unsupervised learning   4. Digital computers and neural networks

d) What is the purpose of using activation function? State its different types?

e) Construct an architecture graph that describes a feedback neural network has 3 source nodes, 2 hidden neurons, and 4 output neurons.

Question #2 [20 Marks]

a) Write the training algorithms of:

1. Hebb net   2. Perceptron

b) Describe how to represent the following characters (O and X) on the computer screen and then design a Hebb net to classify between O and X characters?

c) The logistic function is defined by:

$$\Phi(x) = \frac{1}{1 + e^{-ax}}$$

whose limited values are 0 and 1. Show that the derivative of $\Phi(x)$ with respect to x is:

$$\frac{\partial \Phi}{\partial x} = a\Phi(x)[1 - \Phi(x)]$$

what is the value of this derivative at the origin?

d) Determine the storage capacity of a Hopfield network with 64 neurons used to store the following:

1. Binary patterns   2. Bipolar patterns

e) Consider the pseudolinear activation function $\Phi(x)$ shown in Fig. 1.

1. Formulate $\Phi(x)$ as a function of x.

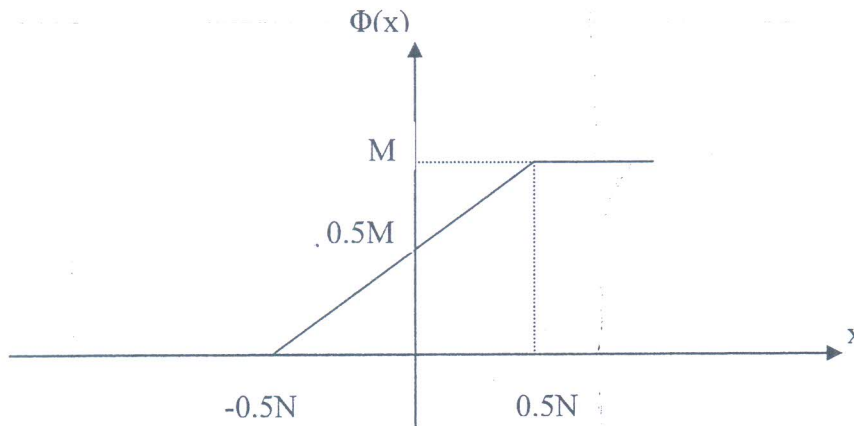2. What happens to $\Phi(x)$ if a is allowed to approach zero?

Fig. 1

Question #3 [20 Marks]

a) Give some applications for neural networks?

b) Design a neural network to perform the following logic operations AND, OR, XOR?

c) Realize the following equation by using neural networks:

$$Z = \frac{3}{\sqrt{18X + 9Y}} + \frac{4}{(8X - 4Y)^2}$$

Draw the architecture of the network and state the values of weights and activation functions?

d) A 2-2-2-1 feedforward neural network has the following weight specification:

between the input and first hidden layer:
w11=4   w12= 1.5   w21=2   w22= -2
between the first and second hidden layer:
w11=2   w12=3   w21=-3   w22= 4
between the second hidden layer and output layer:
w11=-1   w21=1

1. Draw the network structure (write the values of weight between connections).
2. Suppose that all neurons operate in their linear region. Write the input output mapping defining the network.
3. Assume that the activation function is sigmoid for all neurons. Write the input output mapping defining this new network.

Final Exam
Data Structures – Math 441
4th Level
Mathematics Department
Faculty of Sciences
Mansoura University
5th January 2014
Exam Duration: 2 Hours
Questions in 2 Pages – Marks: 60
Answer ALL the Questions

Question One .... **(30 Marks)**

1. Define Collections. What are the Collection Two Types? Compare between them.
2. Compare with figures between Direct Access Collections and Sequential Access Collections.
3. Give an example on: Hierarchical Collections, Set Collections.
4. Using C# Code, write the code needed for the following:
    a. Arrays Declaration and Initialization
    b. Setting and Accessing Array Elements
    c. Creating Multidimensional Arrays
    d. Parameters Arrays
    e. Jagged Arrays
5. Compare between Array and ArrayList.
6. Match the Following (Write the Complete sentence in your answer):

Insert()	Gets or sets an element at the specified index.
InsertRange()	Adds an element to the ArrayList.
IndexOf()	Returns the index of the first occurrence of the specified item.
GetEnumerator()	Removes all elements from the ArrayList.
Clear()	Insert an element into the ArrayList at a specified index.
AddRange()	Adds the elements of a collection to the end of the ArrayList. Capacity: Stores the number of elements the ArrayList can hold.
Add()	Copies the ArrayList or a segment of it to an array.
Count	Determines if a specified item is in the ArrayList.
GetRange()	Returns a subset of the ArrayList as an ArrayList.
CopyTo()	Inserts the elements of a collection into the ArrayList starting at the specified index.
Contains()	Returns an enumerator to iterate over the ArrayList.
Reverse()	Returns the number of elements currently in the ArrayList.
Remove()	Removes the first occurrence of the specified item.
RemoveAt()	
Sort()	Reverses the order of the elements in the ArrayList.
TrimToSize()	Removes an element at the specified index.
ToArray()	Alphabetically sorts the elements in the ArrayList.
Item()	Sets the capacity of the ArrayList to the number of elements in the ArrayList.
RemoveAt()	Copies the elements of the ArrayList to an array.

Question Two .... **(30 Marks)**

1. Design and implement a class that allows a teacher to track the grades in a single course. Include methods that calculate the average grade, the highest grade, and the lowest grade. Write a program to test your class implementation.
2. Modify the previous code so that the class can keep track of multiple courses. Write a program to test your implementation.
3. Rewrite Code in Question 1 using an ArrayList. Write a program to test your implementation and compare its performance to that of the array implementation in ~~Benefit~~ 1 using the Timing class.
4. Illustrate Bubble Sort mechanism of action using both figure and C# code.
5. Compare between Sequential and Binary Search.
6. What are the differences between: Stack and Queue?
7. Given an Empty Stack of Capacity 5, draw the stack after the following operations:
   a. Push (50)
   b. Push (16)
   c. Push (71)
   d. Peek ( )
   e. Pop ( )
   f. Push (28)
   g. Pop
   h. Clear
8. Given an empty Queue of Capacity 6, identify the Queue structure after executing the following operations:
   a. Enqueue(30)
   b. Enqueue(16)
   c. Enqueue(49)
   d. Dequeue( )
   e. Dequeue( )
   f. Dequeue( )

Best wishes,
Dr.Haitham A. El-Ghareeb
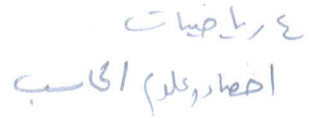
مسموح باستخدام الآلة الحاسبة . **Answer the following questions . All questions carry equal marks**

Question no.1:

1-a) Establish the recurrence relation: $x_{n+1} = \frac{1}{2}(x_n + \frac{a}{x_n})$. Hence, or otherwise, compute $\sqrt{21}$ correct to 3 decimal places .

1-b) Compute $(3)_{-3}$, $(1)_{-5}$ and the Stirling matrices s_5 and S_5 .

1-c) Find $\sum\limits_{r=1}^{n} r(r-1)(r-2)(r-3)(r-4)$.

+

Question no. 2:

2-a) Find an approximate value of the root of the equation $f(x) = x^3 + x - 1 = 0$ by using

   (i) The false position method formula twice,

   (ii) The fixed point iterations.

   (Hint: $f(-0.5) = -0.375$ and $f(1) = 1$).

2-b) Compute one root of $e^x - 3x = 0$ correct to two decimal places by using the bisection method.

Question no. 3:

3-a) Express $f(x) = x^4 - 5x^3 + 3x + 4$ in terms of factorial polynomials.

3-b) By using a suitable algorithm , find an approximated value for y at x=0.1 , given that $y(0) = 0.2$,

$\left.\frac{dy}{dx}\right|_{x=0} = 0.5$ and $\frac{d^2y}{dx^2} + 2x\frac{dy}{dx} - 4y = 0$.

===== END OF EXAM =====

With kind regards

Examiner: Prof. Dr Moawwad El-Mikkawy

١٨ حصـ وعلوم كمبـ / ٤٣١

جامعة المنصورة – كلية العلوم
قسم الرياضيات
التاريخ : 15 / 1 / 2014 م
الدرجة الكلية : 80 درجة
الزمن : ساعتان

امتحان دور يناير 2014م
برنامج : إحصاء وعلوم الحاسب
المستوى: الرابع
اسم المقرر : نظرية إحصائية (2)
كود المادة : ر431

أجب عن الأسئلة الآتية :-

السؤال الأول: . (30 درجة)

أ) يريد صاحب مصنع معرفة نسبة الوحدات التالفة p من انتاج المصنع ولذلك يريد اختبار الفرض الصفرى البسيط
H_0 : $p = 0.2$ ضد الفرض البديل البسيط H_1 : $p = 0.1$ وسوف يستخدم احصائية اختبار x ترمز الى
عدد الوحدات التالفة فى عينة مكونة من 25 وحدة من انتاج المصنع وقد قرر ان يقبل H_0 اذا كان $x \geq 4$.

احسب الخطأ من النوع الأول (α) و الخطأ من النوع الثانى (β)   (15 درجة)

ب) اشرح بالتفصيل كيف يمكن استخدام اختبارات مربع كاى لاختبار استقلال حادثتين .   (15 درجة)

السؤال الثانى: (20 درجة)

القيت زهرة نرد 120 مرة متتالية فكانت البيانات كالاتى :

الوجة	1	2	3	4	5	6
التكرار	15	19	26	20	18	22

هل يمكن القول بان هذة الزهرة متزنة (غير متحيزة) ؟ استخدم مستوى معنوية $\alpha = 0.05$

السؤال الثالث: (30 درجة)

أ) اشرح بالتفصيل خطوات اختبار فرض احصائى حول الفرق بين وسطى مجتمعين مستقلين او غير مستقلين

ب) سحبت عينة عشوائية حجمها n من توزيع طبيعى وسطه μ و تباينه يساوى الواحد الصحيح . اوجد افضل منطقة
رفض ذات حجم α لاختبار H_0 : $\mu = \theta_0$ مقابل H_1 : $\mu = \theta_1$ حيث $\theta_0 > \theta_1$ (15 درجة)

$Z_{0.05} = 1.645$, $Z_{0.025} = 1.96$, $t_{(0.025,10)} = 2.23$, $t_{(0.025,9)} = 2.26$,

$\chi^2_{(0.05,5)} = 11.07$, $\chi^2_{(0.975,3)} = 0.22$, $\chi^2_{(0.05,6)} = 12.59$, $\chi^2_{(0.975,2)} = 0.05$

مع أطيب التمنيات بالتوفيق

د. محمد جـاد

جامعة المنصورة	المستوى الرابع (علوم)	الفصل الدراسي الاول 13-14
كلية العلوم	شعبة : الرياضيات وشعبة الاحصاء وعلوم الحاسب التاريخ : 22/ 1 / 2014	
قسم الرياضيات المادة : نظرية الشبكات (ر418) (Lattice Theory"Math 418")		الزمن: ساعتان

Answer the following five questions:

1- Give two distinct equivalent definitions of meet-semi-lattices.   (5 points)
  And then give an example of each of: (each item 3 points)
  1- A partially ordered set (poset) but not a semi-lattice with 4 elements.
  2- A smallest non- modular lattice,
  3- A modular lattice but not distributive with 6 elements.
  4-Two distributive lattices having 7 elements.
  5- An $\leq$ - homomorphism between two lattices but not $\wedge$- homomorphism.

2- a- Let $(L, \wedge)$ be a meet-semilattice as an algebra.   (10 points)
  Find a semilattice $(L, \leq)$ as a poset equivalent to $(L, \wedge)$.
  Give an example of a $\wedge$-semilattice but not $\vee$-semilattice.

  b- Give all $\vee$-semilattices with 4-element set.   (5 points)
  c- Give an example of a lattice, but neither modular nor distributive.   (5 points)

3-   For a commutative group $G = (G ; \cdot)$.
  a- Show that the set of all subgroups $S_N(G)$ of G (10 points)
     containing the subgroup N forms a lattice.

  b- Find the lattice of all subgroups of the group $(Z_{12} ; +)$.   (10 points).
     Is the lattice of the subgroups of $(Z_{12} ; +)$. distributive? why?

4- a- Let a , x, y be any three elements in a lattice $L = (L ; \vee , \wedge)$.   (8 points)
     Prove that:
  L is distributive $\Leftrightarrow$ " $a \wedge x = a \wedge y$ & $a \vee x = a \vee y \Rightarrow x = y$ ".

  b- Give two equivalent definitions of a $\vee$-ideal of a lattice   (4 points)
     $L = (L ; \vee , \wedge)$ and prove the equivalence between them.

  c – Let θ be a congruence relation on a lattice $L = (L ; \vee , \wedge)$.   (8 points)
     Show that each congruence class $[a]\theta$ is a convex sublattice of L.
     And show also that $[0]\theta$ is a $\vee$-ideal.

Examiner : Dr. Magdi H. Armanious   **Full Mark: 80 points**