

Assiut University September: 2014 Faculty of Science Time: 3 hrs. Department of Math. *Final Exam in the computer Applications in Physics for postgraduate students* 

Code: 649p

# Degree[70 Theor. & 30 pract.]

# Answer the following questions :

1. Use MATLAB to compute the roots of the following polynomial:

$$p(y) = y^{5} + 7y^{4} + 19y^{3} + 25y^{2} + 16\dot{y} + 4$$

2- Use Cramer's rule to find  $v_1$ ,  $v_2$  and  $v_3$  if

 $2v_1 - 5 - v_2 + 3v_3 = 0$ ,  $-4v_1 - 3v_2 - 2v_3 = 8$ ,  $3v_1 - 4 + v_2 - v_3 = 0$ 

and verify your answers with MATLAB.

3 - Use Lagrange's interpolation formula to compute f(2) from the experimental data shown in the following table:

Х	-1.0	0.0	0.50	1.0	2.5	3.0
Y=f(x)	3.0	-2.0	-0.375	3.0	16.125	19.0

4- (a) Explain the The Runge-Kutta method ?

(b) - Compute the approximate value of y at x = 0.2 from the solution y(x) of the differential equation  $y' = x + y^2$  given the initial condition y(0)=1. Use

fourth order Runge-Kutta method with h=0.2 .

5- Use MATLAB to compute the following definite integral:-

$$\int_{0}^{2} x^{4} dx, \qquad n=4$$

Best wishes

A. Y. Bakier



Final Exam of Graduate Students (Pre-Master Degree) Computer Science – Special Course in Computer Science M614 3 Hours – 100 Points



Faculty of Science Mathematics Dept.

## Answer the Following Questions:

#### Question One: (20 Points)

- A. Choose the correct answer for each item of the following:
  - 1. Multiple-processor/core system supporting parallel programming is called the \_\_\_\_\_. (parallel computing, parallel computer, parallel programming).
  - 2. \_\_\_\_\_ computing solves a problem faster using multiple CPUs with Local Memory/CPU (Parallel, Distributed, Scientific).
  - 3. \_\_\_\_\_ is an application programming interface for Local Memory/CPU multiprocessing programming (MPI, PVM, OpenMP).
  - 4. \_\_\_\_\_ strategy is defined as independent tasks apply different operation to same elements of a data set (Data parallelism, Functional parallelism, Domain decomposition)
  - 5. The number of switched nodes needed for a binary tree of depth 5 is \_\_\_\_\_.  $(2^5, 63, \log (2^5 1))$ .
  - 6. In the parallel computing, extending compilers is the approach of developing language compilers to detect and exploit the parallelism in existing programs. (True, Maybe, False)
  - 7. \_\_\_\_\_ supports point-to-point messages among pairs of processors (Shared medium, Switched media, Distributed memory)
  - 8. The min number of edges between switch nodes that must be removed to divide the network into 2 halves is called the \_\_\_\_\_. (diameter, bisection width, range).
  - 9. The diameter of the 2D mesh network of N nodes is \_\_\_\_\_. (4,  $\Theta(\log N)$ ,  $\Theta(\sqrt{N})$ ).
  - 10. The diameter of the binary tree of depth 3 is \_\_\_\_\_. (2 log (3), log  $(2^3)$ , log  $(2^6)$ ).
- B. State four distinct paths for development of applications software for parallel computers. Discuss, briefly, the advantages and disadvantages of two of these paths.

## **Question Two: (20 Points)**

- A. Explain Flynn's Taxonomy.
- B. State the main difference between shared and switched interconnection networks of a parallel architecture.
- C. Suppose p pieces of work are allocated in a cyclic fashion to n processors:
  - 1. Which pieces of work are assigned to processor k, where  $0 \le k \le n 1$ ?
  - 2. Which processor is responsible for the piece of work j, where  $0 \le j \le p-1$ ?
  - 3. What are the most pieces of work assigned to any process?
  - 4. Identify all processes having the most pieces of work.
  - 5. What are the fewest pieces of work assigned to any process?
  - 6. Identify all processes having the fewest pieces of work.

Please Flip the Paper,,,

#### **Question Three: (20 Points)**

- A. Explain, briefly with figures, the main four steps of the Foster Methodology?
- B. Write an MPI program in which each process calculates and prints the sum of the following series:

Process 0:  $\frac{1}{1} + \frac{1}{2} + \frac{1}{3} + \dots + \frac{1}{n}$ Process 1:  $\frac{1}{2} + \frac{1}{4} + \frac{1}{6} + \dots + \frac{1}{2n}$ ...

Process p - 1:  $\frac{1}{p} + \frac{1}{2p} + \frac{1}{3p} + \dots + \frac{1}{np}$ 

Process 0 should compute the average of all of these sums and print it. Set n = 1000.

#### **Question Four: (20 Points)**

- A. Draw a binary tree network switch connecting n processor nodes where n = 8, compute the diameter, the bisection width, and max number of edges per switch node. State the main drawback of the binary tree network.
- B. Draw the data dependence graph of the following code. Explain dependents or independents between each pair of S2, S5, S7, S8 and S9.
- S2. sum = 0 S3. read j P4. if j >= 0 then S5. sum = sum + j P6. if sum < 100 then S7. done = 1 endif endif S8. print done S9. print sum

S1. done = 0

#### **Question Five: (20 Points)**

- A. Define the cash coherent problem.
- B. Consider the directory-based protocol for the cache coherence problem as shown in the following figure. Assume the following five operations now occur in the order listed: CPU 2 reads X, CPU 2 write 5 to X, CPU I reads X, CPU 0 reads X, CPU I writes 9 to X. Show the states of the directories, caches, and memories after each of these operations.



Best Wishes, Dr. Emad H.A. Mabrouk

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#### The End of the Questions

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University of Assiut	· /	0			Da	te: September 2014
Department of Mathematics		تامغار تامغار سبوط				Time : 3 hours
	M.Sc. S	. Exam ( tatistics (	Chemist (641M)	ry)	-	
Answer the following	ng que	estion	S			
1- Write short notes for the	ne follov	ving:				Sala in the s
Random variable, Qua	litative	variable	, Quar	titativ	ve varia	ble and Simple
random sample.						(10 Mark)
Compute the mean, mediaskewness $Sk_1$ and discuss3- By using Spearman's rhpairs:X7	an, stan the existed the	dard de stence c he corr 5	viation of outli- elation 8	$\mathbf{Q}_1$ , $\mathbf{Q}_1$ , ers. betwee	$\mathbf{Q}_3$ , the even the $6$	he coefficient of (10 Mark) following <b>X</b> – <b>Y</b>
Y 4	9	7	9	8	11	
						(10 Mark)
<ul><li>4- If a family has four chi</li><li>a) three of the children</li><li>b) all children are girls</li></ul>	ldren, th are boys	nen com	pute th	ne prol	bability	y that :
c) at least two of the children are boys. (10 Mar						
5- Find the mean, variance	e and sta	indard d	leviatio	on of t	he nun	nber of boys if 8
babies are born. (10 Mark						
6- If the age, X, of the workstandard deviation 2.5 years	omen is r rs, comj	normall pute the	y distri follow	ibuted ving p	with n robabil	nean 65 and ities
$\mathbf{P}(\mathbf{X} < 6$	7), <b>P</b> (6	54 <b>&lt; X</b> <	< 68)			(10 Mark)

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7- If the standard deviation of the cholesterol level is known to be 100 mg/dL.
Compute 95% confidence interval for the mean cholesterol level from the following 10 observed cholesterol levels: 150, 200, 130, 350, 320, 220, 110, 400, 180, 310.

8- In a sample of 49 observations the sample mean and standard deviation were 21 and 11, respectively. Can it be concluded from these data that the population mean is less than 30 when  $\alpha = 0.05$ . (10 Mark)

9- Assume a researcher was interested in estimating the mean reading speed (number of words per minute) of high school graduates and computing the 95% confidence interval. A sample of 6 graduates was taken and the reading speeds were observed as: 200, 240, 300, 410, 450, 600. (10 Mark)

10- Use  $\alpha = 0.01$  to test the hypothesis that the mean maximum voluntary ventilation value for apparently healthy college seniors is not equal 110 liters per minute from the following sample of 20 values:

132	33	91	108	67	169	54	203	190	133
138	157	110	84	166	63	21	187	30	96

(10 Mark)

The following tabulated values may be used:

t(0.025,5)=2.571, t(0.01,19)=1.328,  $\chi^2(0.025,5)=12.832$ , t(0.005,19)=2.861  $\Phi(0.8)=0.7881$ ,  $\Phi(-0.4)=0.3446$ ,  $\Phi(1.2)=0.8849$ 

With my best wishes



The following tabulated values may be used:

t(0.025,30)=2.045, t(0.01,12)=2.68, F(0.95,2,9)=4.26, t(0.005,12)=3.055,

 $t(0.05,18)=1.73, \chi^2(0.95,6)=12.6$ 

# Answer the following questions

	141.3.	F
4		
2		
39		
3	9	9

b) The following table is based on a study of the relationship between race and blood type in a country

	Blood type						
	0	A	B	AB			
Race 1	170	160	100	70			
Race 2	79	40	50	13			
Race 3	17	21	9	8			

Use  $\alpha = 0.05$  to test the null hypothesis that there is no relationship between race and blood type in the country under consideration.

(20 Mark)

(2) The following are the systolic blood pressures (m m Hg) of 13 patient

undergoing drug therapy for hypertension:

184, 154, 191, 173, 162, 145, 173, 116, 114, 147, 140, 160

Can we conclude on the basis of these data that the population mean less than

160? Let  $\alpha = 0.01$ 

(20 Mark)

(3) Drug A was prescribed for a random sample of 14 patients complaining of insomnia. An independent random sample of 18 patients with the same complaint received drug B. The numbers of hours of sleep experienced during the second night after treatment began were as follows:

A: 3.5, 5.7, 3.4, 6.9, 7.8, 3.8, 3.0, 6.4, 6.8, 3.6, 6.9, 5.7, 6.7, 6.1

B: 4.5, 11.7, 10.8, 4.5, 6.3, 3.8, 6.2, 6.6, 7.1, 6.4, 4.5, 5.1, 3.2, 4.7, 4.5, 3.0, 4.0, 5.5

Construct a 95 percent confidence interval for the difference between the population means. Assume that the population variances are equal.

(20 Mark)

(4) Does sensory deprivation have an effect on a person's alpha wave frequency? Twenty volunteer subjects were randomly divided into two groups. Subjects in group A were subjected to a 10 day period of sensory deprivation, while subjects in group B served as controls. At the end of the experimental period the alpha-wave frequency component of subjects electroencephalograms were measured. The results were as follows:

Group A: 10.2, 9.5, 10.1, 10.0, 9.8, 10.9, 11.4, 10.8, 9.7, 10.4 Group B: 11.0, 11.2, 10.1, 11.4, 11.7, 11.2, 10.8, 11.6, 10.9, 10.9

Let  $\alpha = 0.05$  and assume that the population variances are equal.

(20 Mark)

(5) The following table shows the lifetimes in hours of samples from three different types of television tubes manufactured by a company

Sample 1	407	411	409	409
Sample 2	404	406	407	403
Sample 3	410	408	406	408

Test at 0.05 level of significance whether there is a significance difference in the three types. (20 Mark)