

# Baghdad University College of Science Department of Mathematics Competitive Exam M.Sc (No.3) 2016-2017

Notes:

- 1- The applicants for <u>Pure</u> mathematics should answer Group A & Group B.
- 2- The applicants for <u>applied</u> mathematics can answer Group A & Group B OR Group B & Group C.

### **Group** A

Q1) Indicate whether the following statements are true or false .(30 marks)

- 1- Every invertible element in a ring R is a non-zero divisor.
- 2- Let L:V→W be a linear transformation, if dimV=dimW and L is onto, then L is one to one.
- 3- If  $S = \{X_1, X_2, \dots, X_n\}$  is a basis for a vector space V, then every vector in V can be written in one and only one way as a linear combination of vectors in S.
- 4- The set of rational numbers is not zero set.
- 5- The interval (0,1) is a compact subset of  $\mathbb{R}$ .
- 6- If f is analytic lies on a straight line L in  $\mathbb{C}$ , then f is a constant map.

7- Let f be analytic in C and  $f(z) = \sum_{n=0}^{\infty} a_n z^n$ . If f(z) = f(-z)

 $\forall z \in \mathcal{C}$ , then  $a_n = 0$ ,  $\forall n$  even number.

8- The ring of integer is a local ring.

9- Let A and B be two sets, then  $P(A) \cap P(B)=P(A \cap B)$ , where P(A) denotes the power set of A.

10- Every abelian group is cyclic.

#### Q2:

- a) For each n= 0, 1, 2, ... define a function P<sub>n</sub> on ℝ by P<sub>n</sub>(x) = x<sup>n</sup>.
  Show that the set {P<sub>0</sub>, P<sub>1</sub>, P<sub>2</sub>,.....}} is a linearly independent subset of the vector space of continuous functions on ℝ.
  - b) Let  $f: R \to S$  be an epimorphisim of commutative rings. If S is a field, show that *kerf* is a maximal ideal of R. (10 marks)
- **Q3**: a) Compute  $\int_{c} \frac{1}{z} dz$  where *c* is any positively oriented

simple closed contour surrounding the origin.

b) Give an example of a function  $f:[a, b \rightarrow]\mathbb{R}$  which is discontinuous everywhere. (10 marks)

### **Group B**

# Q1)Choose the proper selection for the following statements: (30 marks)

1-Two cards are drawn from a beck of 52 cards without replacement. Let A={The first card is a spade},and B={The second card is a spade}. Then

a.  $P(A \cup B) = 3/51$  b.  $P(A \cup B) = 51/3$  c.  $P(A \cup B) = 3/5$ 

2- Two machines work independently . Machine A works with probability 0.8. The conditional probability that machine B works given that machine A works is 0.5. The conditional probability that machine A works given that machine B works is

a. 0.22. b. 0.23 c. 0.32

- 3- In which of the following method, we approximate the curve of solution by the tangent in each interval.
  - a. Picard's method, b. Euler's method, c. Newton's method d. Runge Kutta method

4- If the general solution of  $t^2 \frac{d^2 y}{dt^2} - 4t \frac{dy}{dt} + 6y = 0$  is of the form

 $y = At^2 + Bt^3$  for appropriate constants A and B, what is the value of the solution y(2) that satisfies y(1) = 2 and y'(1) = -1.

a. y(2) = -10. b. y(2) = 12. c. y(2) = -5. d. y(2) = -12.

5- Consider the equation

$$y'' + (\frac{x^2 \sin x}{e^2 \sqrt{\pi}})^8 (y')^3 + xy = 10$$

This equation is

a. An ordinary, linear differential equation of order 2

b. An ordinary, nonlinear differential equation of order 2

c. An ordinary, linear differential equation of order 3

d. An ordinary, nonlinear differential equation of order 3

6- The solution of the differential equation 4y'' + 9y = 0, where

 $c_1, c_2$  are constants, is

a. 
$$y = c_1 e^x + c_2 e^{-x}$$

b.  $y = c_1 e^x + c_2 e^{-4x}$ c.  $y = c_1 \cos(x) + c_2 \sin(x)$ d.  $y = c_1 \cos(3x/2) + c_2 \sin(3x/2)$ 7- If the exact solution is A and the numerical solution is B, then the absolute error is a. |A+B|,b. |A+B|/|A|, c. |A-B|8- A quantity used to measure the quality of matrix A is called condition number and defined as a.  $K(A) = ||A|| ||A^T||$ , b.  $K(A) = ||A|| ||A^{-1}||$ 9- Match the following two sets: Set one: A. Newton-Raphson, B. Runge-Kutta, C. Gauss-Seidel, D. Simpson's Rule **Set two**: 1. Integration, 2. Root finding, 3. Ordinary Differential Equations, 4. Solution of system of Linear Equations The correct sequence is A2-B3-C4-D1 b. A3-B2-C1-D4 a. A1-B4-C2-D3 d. A4-B1-C2-D3 c. 10- For the equation  $x^3 + 3x - 1 = 0$  the root of the equation lies in the interval a. (1,3) b. (-2,0) c.(0,1)d. (2,4) Q2) (10 marks) a) Find the general solution of  $y'' - 2y' - 3y = e^{2t}$ . b) Find the area between the curve  $y=4-x^2$  and the x-axis. Q3) (10 marks) Find numerically the exact value of  $\int x \, dx$ 

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## <u>Group C</u>

### Q1) Choose the proper selection for the following statements: (30)

marks)

#	Statement
1	Which of the following require large computers memory?
	a. Imaging, b. Graphics,
	c. Voice, d. All of Above
2	Magnetic disks are the most popular medium for
	a. Direct access, b. Sequential access,
	c. Both of above, d. None of above
3	The most commonly used standard data code to represent
	alphabetical, numerical and punctuation characters used in
	electronic data processing system is called
	a. ASCII, b. EBCDIC,
	c. BCD, d. All of above
4	Personal computers used a number of chips mounted on a
	main circuit board. What is the common name for such
	boards?
	a. Daughterboard, b. Motherboard,
	c. Father board, d. Childboard
5	Which bitwise operator is suitable for turning on a
	particular bit in a number?
	a. && operator, b. & operator,
	c.    operator, d.   operator

RATS stand for:

- a. Regression Analysis Time Series,
- b. Regression Analysis Time Sharing,
  - c. Real Analysis Series, d. All of above

CD-ROM is a:

6

7

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a. Memory register, b. Semiconductor memory,

c. Magnetic memory, d. None of above

In a graph if e=[u, v], then u and v are called

a. endpoints of e, b. adjacent nodes

c. neighbors, d. all of above

Which of the following memories has the shortest access times?

- a. Cache memory, b. Magnetic bubble memory,
  - c. Magnetic core memory, d. RAM

To represent hierarchical relationship between elements,

10 which data structure is suitable?

a. Deque, b. Priority, c. Tree, d. All of above

**Q2**) Write a program to determine the sum of even numbers lay within the range [13,1503] which are multiples of the numbers 5, 11.

(10 marks)

Q3) Write a program to determine the sum for the following: (10 marks)

$$S_n = \sum_{n=1}^{10} \frac{(2n+1)! \ n}{(n)! \ (n+3)!}$$

### Group C

#### Q1) (20 marks)

Consider the ODE

y<sup>//</sup>- 49 y=0, y(0)=1, y<sup>/</sup>(0)=0

a) Solve the given equation by using Laplace transform.

b) Solve the given equation by using series method

c) Match the solution in (a) and (b).