Department of Mathematics
College of Science
University of Baghdad
Test of New Applicants for Graduate Studies
MSc. of Applied Mathematics 2017-2018

Note: Answer all the questions.

Q1. For each of the following statement specify whether the statement is true or false.

1. If $\sum_{n=1}^{\infty} a_n$ is convergent, then so is $\sum_{n=1}^{\infty} {a_n}^2$.
2. The limit $\lim_{(x,y)\to(0,0)} \frac{xy}{x^2+y^2}$ does not exist.
3. The following compound statement is tautology $(p \wedge \sim q) \wedge (\sim p \vee q)$.
4. If A is $n \times n$ matrix, then the rank of A is equal n if and only if det(A) $\neq 0$.
5. If A is an event of a sample space with $P(A) = p(\bar{A})$, then $P(A) = 0.5$.
6. A random variable is a random number.
7. The field of rational numbers is complete.
8. If f:$(a, b) \to R$ is a differentiable function, then f is continuous
9. The Trapezoidal rule to approximate an integral function use an interpolation polynomial of degree two.
10. Newton-Cotes methods are easier to compute nodes and weights than Gaussian methods.
11. If $y_1(t)$ and $y_2(t)$ are two solutions of equation $\ddot{y} + p(t)\dot{y} + q(t)y = 0$, then the formula $y(t) = c_1 y_1(t) + c_2 y_2(t)$ gives all solutions to the given equation.
12. The equation $\ddot{y} + 2\dot{y} + \cos(t)\, y = t^2 + 6t + 9$ is linear, second order non-homogeneous differential equation.

Q2. a) Let $f(x) = \frac{1}{1+x}$. Find the Lagrange polynomial passing through the points $(0, f(0))$; $(1, f(1))$ and $(2, f(2))$?

b) Find the bound of the number of iterations needed to achieve a approximation with accuracy 10^{-3} to the solution of $x^3 - x - 1 = 0$ lying in the interval [1,4]?

Q3. a) Prove that S= $\{1, \frac{1}{2}, \frac{1}{3}, \ldots\ldots, \frac{1}{n}, \ldots\ldots\}$ is not compact