Exam Questions on the Computational Methods (Fall 2018)

1. Statement of the problem of interpolation.
2. Lagrange's interpolation formula for arbitrarily specified nodes.
3. Uniqueness of the Lagrange's interpolation formula.
4. Error estimate of Lagrange's interpolation formula.
5. Linear and Parabolic Lagrange's interpolation formulas.
6. Finite differences of various orders.
7. Divided differences of various orders.
8. Newton's forward interpolation formula for equally specified nodes.
9. Newton's backward interpolation formula for equally specified nodes.
10. Newton's interpolation formula for arbitrarily specified nodes.
11. Formulas of approximate differentiation based on Newton's interpolation formulas.
12. Newton-Cotes formulas for numerical integration.
13. Special cases of Newton-Cotes formulas.
14. Simple and composite rectangle formulas for numerical integration.
15. Error in rectangle formula.
16. Simple and composite trapezoid formulas for numerical integration.
17. Error in trapezoid formula.
18. Simple and composite Simpson's formula for numerical integration.
19. Error in Simpson's formula.
20. **LU** factorization method for the system of linear algebraic equations.
21. The Square root method for the system of linear algebraic equations.
22. The Simple iteration method for system of linear algebraic equations.
23. The Gauss-Seidel method for system of linear algebraic equations.
24. The Successive approximation method for numerical solution of non-linear algebraic equations.
25. The Secant method for numerical solution of non-linear algebraic equations.
26. The Tangent method for numerical solution of non-linear algebraic equations.
27. The Power series method for integration of ordinary differential equations.
28. Picard's method for the numerical solution of the Cauchy problem for ODEs.
29. Euler's method for the numerical solution of the Cauchy problem for ODEs.
30. Runge-Kutta (R-K) method for the numerical solution of the Cauchy problem for ODEs.
31. Adams-Bashforth method for the numerical solution of the Cauchy problem for ODEs.
32. Stermer's method for the numerical solution of the Cauchy problem for ODEs.
33. The Finite Difference method for second order linear differential equations.
34. The Tridiagonal Matrix Algorithm (TDMA) for the numerical solution of linear differential equations
35. The Collocation method for BVP.
36. The Galerkin method for BVP.
37. The Finite difference method (FDM) for the Poisson equation.
38. The Finite difference method FDM for one-dimensional wave equation.
39. The Finite difference method FDM for one-dimensional heat equation.
40. Degenerated Kernels method for integral equations.

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