Started on	Thursday, 22 April 2021, 11:39 AM
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Time taken	7 mins 19 secs
Grade	**25.00** out of 25.00 (**100**%)

Question **1**

Correct

Mark 1.00 out of 1.00

We would like to measure and store the length of strings in *meters* on our computer. Some of the strings are very long (~100m) and some are very short (~0.1m). We only require measurements and consequently our numbers to be precise at the millimeter level whether the strings are long or short. Which one of the following representations is a better match for this problem?

Select one:

- a. Integer representation
- b. Fixed-point representation ✔
- c. Floating-point representation

Your answer is correct.

The correct answer is: Fixed-point representation

Question **2**

Correct

Mark 1.00 out of 1.00

If we sequentially add new points, then it is easier to use Newton's divided differences than Lagrange's method for interpolation.

Select one:

- True ✔
- False

The correct answer is 'True'.

Question **3**

Correct

Mark 1.00 out of 1.00

Match the properties to root-finding approaches.

Convergence depends on the first derivative magnitude around the root.	Fixed point iterations ✔
Requires computation of the derivative	Newton-Raphson Method ✔
It is possible to compute the required number of iterations based on the expected precision.	Bisection Method ✔

Your answer is correct.

The correct answer is: Convergence depends on the first derivative magnitude around the root. → Fixed point iterations, Requires computation of the derivative → Newton-Raphson Method, It is possible to compute the required number of iterations based on the expected precision. → Bisection

Method

Question **4**

Correct

Mark 1.00 out of 1.00

If we would like to find a root of f(x) = x^2 - 4*x + 3 in the interval [-1, 2] using bisection, what will be the search interval after the first iteration?

Select one:

- a. [-1, 0.5]
- b. [0, 2]
- c. [1, 2]
- d. [-1, 0]
- e. [0.5, 2] ✔

Your answer is correct.

The correct answer is: [0.5, 2]

Question **5**

Correct

Mark 1.00 out of 1.00

We can convert an ill-conditioned linear system to a well-conditioned one by pivoting.

Select one:

- True
- False ✔

The correct answer is 'False'.

Question **6**

Correct

Mark 1.00 out of 1.00

Which of the following requires an initial interval with suitable properties to start iterations for root finding?

Select one:

- a. Fixed-point iterations
- b. Lagrange interpolation
- c. Bisection ✔
- d. Divided differences
- e. Newton-Raphson

Your answer is correct.

The correct answer is: Bisection

Question **7**

Correct

Mark 1.00 out of 1.00

Which type of computations involve loss of significance due to roundoff error in the floating point number representation?

Select one:

- a. When dividing by a very small number.
- b. When subtracting two very large numbers.
- c. When taking square roots.
- d. When subtracting two numbers with very close values. ✔
- e. When subtracting two very small numbers.

Your answer is correct.

The correct answer is: When subtracting two numbers with very close values.

Question **8**

Correct

Mark 1.00 out of 1.00

Which of the following is not a valid operation for the solution of a linear system of equations using Gaussian elimination?

Select one:

- a. Subtracting a multiple of a row from other rows.
- b. Exchanging the order of two rows.
- c. Subtracting two rows from a third one at the same time.
- d. Multiplying a row by a non-zero scalar.
- e. Taking the square of the elements in one row. ✔

Your answer is correct.

The correct answer is: Taking the square of the elements in one row.

Question **9**

Correct

Mark 1.00 out of 1.00

What is the polynomial passing through (1, 2) and (2, 1) computed by Newton's divided differences?

Select one:

- a. 2 - (x - 1) ✔
- b. 2 + (x - 1)
- c. 1 - (x - 2)
- d. 1 + (x - 2)
- e. 2 - (x + 1)
- f. 1 - (x + 2)

Your answer is correct.

The correct answers are: 2 - (x - 1), 1 - (x - 2)

Question **10**

Correct

Mark 1.00 out of 1.00

Which of the following corresponds to the Horner's method of evaluating P(x) = 2*x^4 -x^3 + 3*x^2 - 2*x + 5?

Select one:

- a. f(x) = (2 * (x * x * x - 1) + (-x + 3) * x) * x + 5
- b. f(x) = (((2 * x - 1) * x + 3) * x - 2) * x + 5 ✔
- c. f(x) = ((2*x - 1) * x*x + (3*x - 2)) * x + 5
- d. p(x) = x*x; q(x) = x*p(x); r(x) = x*q(x); f(x) = 2*r(x) - q(x) + 3 * p(x) - 2*x + 5
- e. f(x) = 2*x*x*x*x -x*x*x + 3*x*x - 2*x + 5

Your answer is correct.

The correct answer is: f(x) = (((2 * x - 1) * x + 3) * x - 2) * x + 5

Question **11**

Correct

Mark 1.00 out of 1.00

We want to ensure our diet contains exactly 500mg of Vitamin C at a cost of 20 TL. Carrots contain 60 mg/kg, white cabbage contains 300 mg/kg of Vitamin C. Carrots cost 3 TL/kg and white cabbage costs 10 TL/kg. Writing the required weight of carrots a C and the required weight of white cabbage as W, which of the following systems do we need to solve?

Select one:

- a. 60 C + 500 W = 300; 3 C + 30 W = 10
- b. 60 C + 300 W = 20; 3 C + 10 W = 500
- c. 60 C + 10 W = 500; 300 C + 10 W = 20
- d. 300 C + 60 W = 500; 10 C + 3 W = 20
- e. 60 C + 300 W = 500; 3 C + 10 W = 20 ✔

Your answer is correct.

The correct answer is: 60 C + 300 W = 500; 3 C + 10 W = 20

Question **12**

Correct

Mark 1.00 out of 1.00

If we want to find where the function f(x) achieves its minimum value close to a starting point x0, we can solve this problem by

Select one:

- a. using Horner's method
- b. finding the root of its first derivative f'(x) ✔
- c. interpolating it around x0
- d. using bisection of f(x) in an interval around x0
- e. writing and solving the corresponding linear system of equations

Your answer is correct.

The correct answer is: finding the root of its first derivative f'(x)

Question **13**

Correct

Mark 1.00 out of 1.00

Bisection method's convergence rate is faster than Newton's method since we divide the interval in half at every iteration.

Select one:

- True
- False ✔

The correct answer is 'False'.

Question **14**

Correct

Mark 1.00 out of 1.00

Using a floating-point representation similar to IEEE754, if we have two bits for the significand (mantissa) and a possible set of exponent parts as 2^-1, 2^0, and 2^1, which of the following numbers we can not represent as a normalized number?

Select one:

- a. 1.25
- b. 0.75
- c. 2
- d. 2.25 ✔
- e. 1.5

Your answer is correct.

The correct answer is: 2.25

Question **15**

Correct

Mark 1.00 out of 1.00

If we have a nonlinear system of 5 equations in 4 unknowns, what are the dimensions of the Jacobian for this system?

Select one:

- a. 5-by-4 ✔
- b. 5-by-1
- c. 4-by-1
- d. 4-by-5
- e. 1-by-1 (scalar)

Your answer is correct.

The correct answer is: 5-by-4

Question **16**

Correct

Mark 1.00 out of 1.00

Which of the following is false for approximating a function using a finite set of its values and interpolation?

Select one:

- a. We can use Lagrange's or Newton's methods for interpolation to get the same results.
- b. Approximation quality is independent of the number of interpolation points. ✔
- c. If the function has smaller high order derivatives, it will be easier to approximate.
- d. We can approximate non-linear functions.
- e. The approximation error is smaller close to the interpolation points.

Your answer is correct.

The correct answer is: Approximation quality is independent of the number of interpolation points.

Question **17**

Correct

Mark 1.00 out of 1.00

What is the Jacobian of the following nonlinear system of equations? f1(x,y) = 2*x + 3*y^2; f2(x,y) = 2*x^2 + 6 (Note that the answers are written in row-major order (row-by-row)).

Select one:

- a. [[2, 6*y], [4*x, 0]] ✔
- b. [[2, 0], [4*x, 6*y]]
- c. [[2*x, 3*y^2], [2*x^2, 6]]
- d. [[4*x, 6*y], [2, 0]]
- e. [[2, 4*x], [6*y, 0]]

Your answer is correct.

The correct answer is: [[2, 6*y], [4*x, 0]]

Question **18**

Correct

Mark 1.00 out of 1.00

The smallest floating number that we can represent and is greater than 1 is (1 + machine epsilon).

Select one:

- True ✔
- False

The correct answer is 'True'.

Question **19**

Correct

Mark 1.00 out of 1.00

For Gaussian elimination, backward substitution is the most costly step.

Select one:

- True
- False ✔

The correct answer is 'False'.

Question **20**

Correct

Mark 1.00 out of 1.00

What is the Lagrange polynomial passing through points (1, 2), (2, 1)?

Select one:

- a. 2 * (x - 2) / (1 - 2) + 1 * (x - 1) / (2 - 1) ✔
- b. 2 * (x - 1) / (1 - 2) + 1 * (x - 2) / (2 - 1)
- c. 2 * (x - 2) / (2 - 1) + 1 * (x - 1) / (1 - 2)
- d. 1 * (x - 2) / (1 - 2) + 2 * (x - 1) / (2 - 1)

Your answer is correct.

The correct answer is: 2 * (x - 2) / (1 - 2) + 1 * (x - 1) / (2 - 1)

Question **21**

Correct

Mark 1.00 out of 1.00

Which one of the following is not a property of the Newton's method for root finding?

Select one:

- a. It can not converge if the derivative magnitude is around one. ✔
- b. It requires computation of the first derivative.
- c. It requires evaluation of the function itself.
- d. Its convergence rate is linear near a repeated root.
- e. Its convergence rate can be quadratic.

Your answer is correct.

The correct answer is: It can not converge if the derivative magnitude is around one.

Question **22**

Correct

Mark 1.00 out of 1.00

Which one of the following is the update rule for Newton's method if we try to find the roots of f(x) = x^2 - 4*x +3?

Select one:

- a. (x^2 - 4*x + 3) / (2*x - 4)
- b. (3 * x^2 - 8*x + 3) / (2*x - 4)
- c. (x^2 - 3) / (2*x - 4) ✔
- d. (3 * x^2 - 8*x + 3) / (x - 4)
- e. (x^2 - 3) / (x - 4)

Your answer is correct.

The correct answer is: (x^2 - 3) / (2*x - 4)

Question **23**

Correct

Mark 1.00 out of 1.00

What is the purpose of using the LU decomposition instead of the Gaussian elimination?

Select one:

- a. To improve precision of computations
- b. To be able to solve problems with zero pivots.
- c. Reduce number of computations when the right side of the linear equation changes for the same matrix on the left side. ✔
- d. To turn ill-conditioned problems to well conditioned ones.
- e. To decrease forward error compared to Gaussian elimination.

Your answer is correct.

The correct answer is: Reduce number of computations when the right side of the linear equation changes for the same matrix on the left side.

Question **24**

Correct

Mark 1.00 out of 1.00

Fixed point iterations will converge to a fixed point r if the derivative of the function is negative at the root.

Select one:

- True
- False ✔

The correct answer is 'False'.

Question **25**

Correct

Mark 1.00 out of 1.00

Which of the following is true for the error analysis of root finding?

Select one:

- a. The relation between forward and backward errors does not depend on the condition number.
- b. For a well-conditioned problem, a large backward error results in a small forward error.
- c. For an ill-conditioned problem, a small backward error results in a small forward error.
- d. For a well-conditioned problem, backward and forward errors are unrelated.
- e. For a well-conditioned problem, a small backward error results in a small forward error. ✔

Your answer is correct.

The correct answer is: For a well-conditioned problem, a small backward error results in a small forward error.

Question **26**

Complete

Not graded

Please type your student id.

Answer: 234567890

The correct answer is: 1234567890