Computational Mathematics assignment – 3

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Q1. Answer, E - none of the above

we can see that none of the given answers represents the square root of matrix B divided by matrix A. x = sqrt(B/A)

02. Answer, B – error

```
>> for i=1:5
for j=1:6
a(i,j)=input();
end
end
Error using input
Not enough input arguments.
```

We can see from the below screen that an error message is displayed when we try to run the code.

Q3. Answer, E - none of the above

To plot distinct functions in the same graph, we must pass multiple inputs of pairs of matrices to represent each plot.

Q4. Answer, E - none of the above

For this question:

x0=0, x1=1, x2=23, x3=13

f(x0)=1, f(x1)=0, f(x2)=12, f(x3)=0.866

Using the Newtonian method for interpolation with the following formulas :

$f[x_i,x_{i+1}]= f[x_{i+1}]−f[x_i]/x_{i+1}−x_i$

$f[x_i,x_{i+1},x_{i+2}]= f[x_{i+1},x_{i+2}]−f[x_i,x_{i+1}]/x_{i+2}−x_i$

$f[x_i,x_{i+1},x_{i+2} ,x_{i+3}]= f[x_{i+1},x_{i+2}, x_{i+3}]−f[x_i,x_{i+1}, x_{i+2}]/x_{i+3}−x_i$

$F[X_0,X_1]=F[X_1]−F[X_0]/X_1−X_0= 0−1/1−0= −1$

$F[X_1,X_2]=F[X_2]−F[X_1]/X_2−X_1= 1/2−0/2/3−1= −3/2$

$F[X_2,X_3]=F[X_3]−F[X_2]/X_3−X_2= 0.866−1/2 / 1/3 − 23 = −1.098$

$F[X_0,X_1,X_2]= F[X_1,X_2]−F[X_0,X_1]/X_2−X_0= −1.5−(−1)/2/3−0= −0.75$

$F[X_1,X_2,X_3]= F[X_2,X_3]−F[X_1,X_2]/X_3−X_1= −1.098−(−3/2) / 1/3−1= −0.603$

$f[x_0,x_1,x_2,x_3]= f[x_1,x_2, x_3]−f[x_0,x_1, x_2]/x_3−x_0= −0.603−(−0.75) / 1/3−0 = 0.441$

$P_3(X)=F[X_0]+F[X_0,X_1](X−X_0)+F[X_0,X_1,X_2](X−X_0)(X−X_1)+F[X_0,X_1, X_2,X_3](X−X_0)(X−X_1)(X−X_2)$

Now evaluating for X=1.5:

$F(1.5)=1+(1.5)(−1)+(1.5)(1.5−1)(0.75)+(1.5)(1.5−1)(1.5−0.6667)(0.441)$

$=1−1.5−0.5625+0.2756= −0.7869 \cong −0.787$

Q6. Answer, E - none of the above

X	11	16	22	24

Y	33	45	63	28

16, 22, 24

45, 63, 28

Using Lagrange′s Interpolation;

$Y=(y0)\ (x-x1)(x-x2)/(x0-x1)(x0-x2)+\ (y1)\ (x-x0)(x-x2)/(x1-x0)(x1-x2)+(y2)(x-x0)(x-x1)/(x2-x0)(x2-x1)$

$= 45 \times (x-22)(x-24)/(16-22)(16-24)+ 63 \times (x-16)(x-24)/(22-16)(22-24)+ 28 \times (x-16)(x-16)/(24-16(24-12)$

$=(x2-46x+528)\times 45/(16-22)(16-24)+(x2-40x+384)\times 63/(22-16)(22-24)+(x2-38x+352)\times 28/(24-16)(24-22)$

$=(x2-46x+528)\times(0.9375)+(x2-40x+384)\times(-5.25)+(x2-38x+352)\times(1.75)$

$=-2.5625x2+100.375x-905$

Differentiate;

$dv/dx=-5.125x+100.375$

Substitute for x=18;

$=-5.125(18)+100.375$

=8.125m/S2

Q7. Answer, A - O(h)

We can see that it is not possible to use the central difference formula to approximate f'(x)in this question as we can use only f(x−h), f(x) and f(x+3h). Therefore, we must use either the forward difference or backward difference formula. For this question's purpose, it is more logical to use the backward difference formula.

$$\left.\frac{df}{dx}\right|_{x=xi} = \frac{f(x_i)-f(x_{i-1})}{x_i - x_{i-1}}$$

Next, we substitute:

xi=x

xi−1=x−h

Next, we can use Taylor's Theorem to expand f(xi−1) to yield:

f(xi−1)=f(xi)−f'(xi)+ (h^2) f''(xi)/2! + (h^3) f'''(xi)/3! + (h^4) f''''(xi)/4!

This can be simplified to:

$$f'(x_i) = \frac{f(x_i)-f(x_{i-1})}{h} + \frac{f''(\xi)}{2!}h$$

$$\frac{f''(\xi)}{2!}h = O\left(h\right)$$

Therefore, the truncation error is O(h).

Q9. Answer, B - 2.296

Let f(x)= sqrt(x2+1) , a=−1, b=1, h=0.2

Subintervals are; [−1, 0.8] , [−0.8, −0.6] , [−0.6, −0.4] , [−0.4, −0.2] , [−0.2, 0] , [0, 0.2]

[0.2, 0.4] , [0.4, 0.6] , [0.6, 0.8] and [0.8, 1]

S10=h/3[f(−1+4(f(−0.8)+f(−0.4)+f(0)+f(0.4)+f(0.8))+2(f(−0.6)+f(−0.2)+f(0.2)+f(0.6))+f(1)]

S10=0.2/3[1.4142+4(1.2806+1.0770+1+1.077+1.2806)+2(1.1662+1.0198+1.0198+1.1662)+1.4142]

S10 = 2.296

$$I = \int_{-1}^{1} f(x)dx \approx 2.296$$