Model Answer

Subject: Programming Based Numerical Analysis (MCA-102)

Class: MCA-I

1i.

$\Delta u = \frac{\partial u}{\partial v} \Delta v$ = $(21.v^6 - 6)$ 0.05 = 15 x 0.05 [v=1]

Error% = $\frac{\Delta u}{u}$ x 100= (15x0.05 / 3) 100 = 25 [u at v=1]

1ii. $1/(0.4x10^{21} - 0.4x10^{4})$

1iii.

	x	f(x)	
	0.3	0.145886003	y0
	0.4	0.575533966	y1
	0.5	0.95557409	y2
H	0.1		
h/2*(y0+2y1+y2) =	**0.112626401**		

1iv. 12

1v. f(0)=1 and f(1)=-1 therefore, root in between 0 and 1

1vi.

X0	1			
	F(X)	**F'(X)**	**Root**	**Error%**
X0	1.718281828	5.436563657	1	
X1 ->	1.718281828	5.436563657	0.683939721	46.21171573
X2	0.355342551	3.337012149	0.577454477	18.44045681

2a.

	x	y=f(x)	
	0	1	y0
	0.1	0.909090909	y1
	0.2	0.833333333	y2
	0.3	0.769230769	y3
	0.4	0.714285714	y4
	0.5	0.666666667	y5
	0.6	0.625	y6
	0.7	0.588235294	y7
	0.8	0.555555556	y8
	0.9	0.526315789	y9
	1	0.5	y10
h=	0.1		
h/3*[y0+4(y1+y3+y5+y7+y9)+2(y2+y4+y6+y8)]=	**0.693150231**		

2b.

	X	y=ex	X-X-bar	Y-Y-bar	(X-X-bar)*(Y-Y-bar)	sqrt(X-Tbar)
	1	2.71828183	-0.3	-1.02483002	0.307449005	0.09
	1.1	3.00416602	-0.2	-0.73894582	0.147789164	0.04
	1.2	3.32011692	-0.1	-0.42299492	0.042299492	0.01
	1.3	3.66929667	0	-0.07381518	0	0
	1.4	4.05519997	0.1	0.312088123	0.031208812	0.01
	1.5	4.48168907	0.2	0.738577227	0.147715445	0.04
	1.6	4.95303242	0.3	1.209920581	0.362976174	0.09
	1.3	3.74311184			1.039438092	0.28
	X-bar	Y-bar			sum1	sum2
a1(=sum1/sum2)		**3.7122789**				
		-				
a0(=ybar-a1*xbar)		**1.08285073**				
y(1.8)=		**5.59925129**				

3a.

X0	2		
	F(X)	F'(X)	Root
X0	-3	9	2
X1			
->	-3	9	2.333333333
X2	0.703703704	13.33333333	2.280555556
X3	0.019351445	12.60280093	2.279020068
X4	1.61271E-05	12.58179741	2.279018786

3b.

x	y	d1	d2	d3	d4	
1921	46					
		20				
1931	66		-5			
		15		2		
1941	81		-3		-3	
		12		-1		
1951	93		-4			
		8				
1961	101					
h						10
x0						1961
x						1955
p=(x-x0)/h						-0.6
y(1955)=101 + p*8 + (p(p+1)/2!)*-4 + (p(p+1)(p+2)/3!)*-1 + (p(p+1)(p+2)(p+3))*-3						**96.8368**

4a.

	x	y	d1	d2	d3	d4	d5
	-4	139					
			-160				
	-2	-21		182			
			22		-182		
	0	1		0		278	
			22		96		-278
	2	23		96		0	
			118		96		
	4	141		192			
			310				
	6	451					

X	-3
x0	-4
H	2
P	0.5

p=(X-(-4))/2=(x+4)/2=x/2 + 2
x=-3
$Y_n(x)$= 139 + (x/2+2)*(-160) +
((x/2+2)(x/2+1)/fact(2))*182 +
((x/2+2)*(x/2+1)*(x/2)/fact(3))*(-182) +
((x/2+2)*(x/2+1)*(x/2)*(x/2-1)/fact(4))*278 +
(((x/2+2)*(x/2+1)*(x/2)*(x/2-1)*(x/2-2)/fact(5))*(-278)

$Y_n(-3)$ = **4.2421875**

4b.
5/3 pivot element
i*5/3 + ii*5/3 => 31y – 45z = 48 -iv
i*1/3 + iii*1/3 => 14y – 12z = 30 -v
from iv & v => z=1
from i*2 - iii => -7x – 10z = 4
system of equation becomes:
-7x – 10z = 4
31y – 45z = 48
Z = 1
(x,y,z)=(-2,3,1)

5a.
$Y_n(x)_1 = ((x-2)*(x-4))/((1-2)*(1-4))*(1) = x^2/3 – 2x + 8/3$
$Y_n(x)_2 = ((x-1)*(x-4))/((2-1)*(2-4))*(7) = -7x^2/2 – 35/2x – 14$
$Y_n(x)_3 = ((x-1)*(x-2))/((4-1)*(4-2)) = 61/6\ x^2 - 61/2x + 61/3$

$Y_n(x) = 7x^2 - 15x + 9$
$Y_n(3) = 27$

5b.
A 1 f(a) -1

B	2	f(b)	5
X1	1.5	f(x1)	0.875
X2	1.25	f(x2)	-0.296875
X3	1.375	f(X3)	0.224609375
X4	1.3125	f(X4)	-0.051513672
X5	1.34375	f(X5)	0.082611084
X6	1.328125	f(X6)	0.014575958
X7	1.3203125	f(X7)	-0.018710613

6a.

x	f(x)	d	d2	d3	d4
1.2	6.216				
		1.938			
1.3	8.154		0.236		
		2.174		0.012	
1.4	10.328		0.248		0
		2.422		0.012	
1.5	12.75		0.26		
		2.682			
1.6	15.432				

H	0.1	
f'(1.2)	18.24	(=1/h(d1-1/2*d2+1/3*d3-1/4*d4)

6b

Newton Raphson for finding root of the equation x3-65=0

X0	4		
	F(X)	F'(X)	Root
X0	-1	48	4
X1 ->	-1	48	4.020833333
X2	0.005217376	48.50130208	4.020725761

7a.

x=	17/20-y*1/20+z*1/10
y=	-9/10-3/20*x+1/20*z
z=	5/4-1/10*x+3/20*y

	x	y	z
0th approx	0	0	0
1st approx	0.85	-1.0275	1.010875
2nd approx	1.002463	-0.99983	0.99978
3rd approx	0.999969	-1.00001	1.000002
4th approx	1.000001	-1	1
5th approx	**1**	**-1**	**1**

7b.

4th order			2nd order		
X0	Y0	h	X0	Y0	h
0	0	0.2	0	0	0.2
K1	0.2		K1	0.2	
K2	0.202		K2	0.208	
K3	0.2020402				
K4	0.202041				
Y(0.2)	**0.2016869**		Y(0.2)	**0.204**	

X0	Y0	h	X0	Y0	h
0.2	0.2016869	0.2	0.2	0.204	0.2
K1	0.2081355		K1	0.208323	
K2	0.2186972		K2	0.234002	
K3	0.2193486				
K4	0.2193892				
Y(0.4)	**0.4189563**		Y(0.4)	**0.425163**	

x0	y0	x0	y0
0	0	0	0
0.2	0.2016869	0.2	0.204
0.4	0.4189563	0.4	0.425163

8.

3	2	4	1	0	0
2	1	1	0	1	0
1	3	5	0	0	1

Swapping R1 and R3

=>

1	3	5	0	0	1
2	1	1	0	1	0
3	2	4	1	0	0

R2=R2-2*R1

1	3	5	0	0	1
0	-5	-9	0	1	-2
3	2	4	1	0	0

R3=R3-3*R1

1	3	5	0	0	1
0	-5	-9	0	1	-2
0	-7	-11	1	0	-3

R2=R2/-5 =>

1	3	5	0	0	1
0	1	1.8	0	-0.2	0.4
0	-7	-11	1	0	-3

R1=R1-3*R2

1	0	-0.4	0	0.6	-0.2
0	1	1.8	0	-0.2	0.4
0	-7	-11	1	0	-3

R3=R3-(-7)*R2

1	0	-0.4	0	0.6	-0.2
0	1	1.8	0	-0.2	0.4
0	0	1.6	1	-1.4	-0.2

R3=R3/1.6

1	0	-0.4	0	0.6	-0.2
0	1	1.8	0	-0.2	0.4
0	0	1	0.625	-0.875	-0.125

R1=R1-(4)*R3

1	0	0	0.25	0.25	-0.25
0	1	1.8	0	-0.2	0.4
0	0	1	0.625	-0.875	-0.125

R2=R2-1.8*R3

1	0	0	0.25	0.25	-0.25
0	1	0	-1.125	1.375	0.625
0	0	1	0.625	-0.875	-0.125

$$A^{-1} = 1/8 \begin{bmatrix} 2 & 2 & -2 \\ -9 & 11 & 5 \\ 5 & -7 & -1 \end{bmatrix} = \begin{bmatrix} 0.25 & 0.25 & -0.25 \\ -1.125 & 1.375 & 0.625 \\ 0.625 & -0.875 & -0.125 \end{bmatrix}$$