Marking Sheet   Assignment 1   CS370 Winter 2018

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Section: 1 (8:30am)   2 (11:30am)   3 (1:30pm)

1.	(a) roots by quadratic formula	(4)	________	
	(b) alternate quadratic formula	(3)	________	
	(c) roots by alternate formula	(3)	________	......../10
2.	(a) Matlab function	(4)	________	
	(b) stability analysis	(6)	________	
	(c) number of steps	(5)	________	......../15
3.	(a) Conditions and values	(6)	________	
	(b) Lagrange	(4)	________	......../10
4.	(a) Linear system	(8)	________	
	(b) Spline coefficients	(8)	________	
	(b) Graphic	(4)	________	........./20
5.	(a) points	(4)	________	
	(b) lines	(4)	________	
	(c) splines	(12)	________	......../20

Total: (75) ____________

CS 370 A1

1. (a) $x_1 = \frac{-22.41 - \sqrt{22.41^2 - 4 \times 1.03 \times 0.1123}}{2 \times 1.03}$

$= \frac{-22.41 - \sqrt{502.21 - 0.46268}}{2.06}$

$= \frac{-22.41 - \sqrt{501.75}}{2.06}$

$= \frac{-22.41 - 22.400}{2.06}$

$= -21.752$

$x_2 = \frac{-22.41 + 22.4}{2.06} = -0.0048544$

$Err_{rel} x_1 = \frac{|-21.752 + 21.752|}{|21.752|} \approx 0$

$Err_{rel} x_2 = \frac{|-0.0050123 + 0.0048544|}{|-0.0050123|} \approx 0.3 \times 10^{-1}$

(b) $x_1 \cdot x_2 = \frac{(-b - \sqrt{b^2 - 4ac}) \cdot (-b + \sqrt{b^2 - 4ac})}{2a \cdot 2a}$

$= \frac{(-b)^2 - (b^2 - 4ac)}{4a^2}$

Then $a \cdot x_1 \cdot x_2 = a \cdot \frac{4ac}{4a^2} = c$

Hence $x_2 = \frac{c}{a x_1}$

(c) x_1 is the same as (a).

$x_2 = \frac{0.1123}{1.03 \cdot (-21.752)} = \frac{0.1123}{-22.405} = -0.0050123$

$Err_{rel} x_2 = \frac{|-0.0050123 + 0.0050123|}{|-0.0050123|} \approx 0$

2.(a) The data in the 11^{th} is larger than the 10^{th}. And if I perform the recursion for the 21^{st} times, the data get ~~errors~~ messed up. And with the amount get larger, the answer get frustrating.

(b) $x_1 = \frac{-a-\sqrt{a^2-4b}}{2}$ $x_2 = \frac{-a+\sqrt{a^2-4b}}{2}$

$$q_n = C_1 \cdot \left(\frac{-a-\sqrt{a^2-4b}}{2}\right)^n + C_2 \cdot \left(\frac{-a+\sqrt{a^2-4b}}{2}\right)^n$$

$$\cancel{K(q_n) = \frac{|q_n|}{}} \quad K(P) = \frac{|n| \; q'_n}{q_n} \approx \frac{|n| \ln\left(\frac{-a-\sqrt{a^2-4b}}{2}\right) + \ln\left(\frac{-a+\sqrt{a^2-4b}}{2}\right)}{C_1 + C_2}$$

$$\approx |n| \in O(n).$$

Because $n \to \infty$, ~~K(P) ≈~~ P is unstable.

(c) Take $n = \cancel{0.5}$ 2×10^{-1}. Then we can see there will be a $O(1)$ error on the 8^{th} number. In the experiment of (a), the 8^{th} number got error, which match the prediction.

3. (a) By observation,

~~$a_1=19,\ a_2=27,\ a_3=6,\ a_4=1$~~

$a_1=19,\ a_2=26,\ a_3=9,\ a_4=1$

(b) $S(-3)=28+19(-3)+9\times(-3)^2+(-3)^3=25$

$S(-1)=26+19(-1)+9\cdot(-1)^2-(-1)^3=\cancel{15}\,17$

$S(0)=26$

$S(3)=26+19\times3+3\times3^2+3^3=137.$

$$L_1(x)=\frac{(x+1)(x-0)(x-3)}{(-2)(-3)(-6)}=\frac{(x+1)\times(x-3)}{-36}$$

$$L_2(x)=\frac{(x+3)(x-0)(x-3)}{(2)(-1)(-4)}=\frac{(x+3)x(x-3)}{8}$$

$$L_3(x)=\frac{(x+3)(x+1)(x-3)}{(3)(1)(-3)}=\frac{(x+3)(x+1)(x-3)}{-9}$$

$$L_4(x)=\frac{(x+3)(x+1)(x-0)}{(6)(4)(3)}=\frac{(x+3)(x+1)x}{72}$$

$p(x)=25\cdot L_1(x)+17\cdot L_2(x)+26\cdot L_3(x)+137\cdot L_4(x).$

4. (a) $s_1=b_1+2c_1(-1+1)+3d_1(-1+1)^2$

$a_1+b_1(1+1)+c_1(1+1)^2+d_1(1+1)^3=a_2+b_2(1-1)+c_2(1-1)^2+d_2(1-1)^3=1$

$s_2=b_1+2c_1(1+1)+3d_1(1+1)^2=b_2+2c_2(1-1)+3d_2(1-1)^2$

$a_2+b_2(2-1)+c_2(2-1)^2+d_2(2-1)=a_3+b_3(2-2)+c_3(2-2)^2+d_3(2-2)^3=4$

...... twice-dif: $ss_1=2c_1+6d_1(-1+1)$ $\quad ss_2=2c_1+6d_1(1+1)=2c_2+6d_2(1-1)$

(b) $a_1=2$

$a_2=1$

$a_3=4$

$a_4=3$