Islamic University Faculty of Computer and Information Systems		الجامعة الإسلامية كلية الحاسب الآلي ونظم المعلومات

Numerical Computing Methods
Assignment (2)

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Grade

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2. Find the value of an annuity at $5\frac{3}{8}\%$, given the following table:

Rate:	4	$4\frac{1}{2}$	5	0	$5\frac{1}{2}$	6
Annuity value:	172.2903	162.8889	153.7245	145.3375		137.6483

4.5 5.5

$a = 6$, $h = 0.5$, $u = -1.25$, $x = 5.375$

x	y	Δy	$\Delta^2 y$	$\Delta^3 y$	$\Delta^4 y$
4	172.2903				
		-9.4014			
4.5	162.8889		0.237		
		-9.1644		0.5404	
5	153.7245		0.7774		-0.62
		-8.387		-0.0796	
5.5	145.3375		0.6978		
		-7.6892			
6	137.6483				

$$f(5.375) = f(a) + u\Delta y + \frac{u(u+1)}{2!}\Delta^2 y + \frac{u(u+1)(u+2)}{3!}\Delta^3 y + \cdots$$

$$= 137.6483 + (-1.25)(-7.6892) + \frac{(-1.25)(-1.25+1)}{2!}(0.6978) + \frac{(-1.25)(-1.25+1)(-1.25+2)}{3!}(-0.0796)$$

$$+ \frac{(-1.25)(-1.25+1)(-1.25+2)(-1.25+3)}{4!}(-0.62)$$

$$= 137.6483 + (9.6115) + (0.100063) + (-3.1093 \times 10^{-3}) + (-0.010509) = 147.355$$

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4. The table below gives the value of tan x for $0.10 \le x \le 0.30$.

x:	0.10	0.15	0.20	0.25	0.30
$y = \tan x$:	0.1003	0.1511	0.2027	0.2553	0.3093

Find: (*i*) tan 0.50 (*ii*) tan 0.26 (*iii*) tan 0.40.

(i) $x = 0.50$, $a = 0.30$, $h = 0.05$, $u = 4$

x	y	Δy	$\Delta^2 y$	$\Delta^3 y$	$\Delta^4 y$
0.10	0.1003				
		0.0508			
0.15	0.1511		8×10^{-4}		
		0.0516		4×10^{-4}	
0.20	0.2027		1.2×10^{-3}		-4×10^{-4}
		0.0528		0	
0.25	0.2553		1.2×10^{-3}		
0.30	0.3093	0.054			

$f(0.50) = 0.3093 + 0.216 + 0.012 + 0 + (-0.014) = 0.5233$ (i)

(ii) $x = 0.21$, $h = 0.05$, $a = 0.30$, $u = -0.8$

$f(0.26) = 0.3093 + (-0.0432) + (-9.6 \times 10^{-5}) + 0 + (7.04 \times 10^{-6}) = 0.266011$ (ii)

(iii) $x = 0.40$, $h = 0.05$, $a = 0.30$, $u = 2$

$f(0.40) = 0.3093 + (0.108) + 3.6 \times 10^{-3} + 0 + (-2 \times 10^{-3}) = 0.4189$ (iii)

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6. From the following table of values of x and $f(x)$, determine

(i) $f(0.23)$ (ii) $f(0.29)$

x:	0.20	0.22	0.24	0.26	0.28	0.30
$f(x)$:	1.6596	1.6698	1.6804	1.6912	1.7024	1.7139

(i) $u = 1.5$, $x_f = 0.23$, $a = 0.20$, $h = 0.02$

x	y	Δy	$\Delta^2 y$	$\Delta^3 y$	$\Delta^4 y$	$\Delta^5 y$
0.20	1.6596	0.0102	4×10^{-4}	-2×10^{-4}	4×10^{-4}	-7×10^{-4}
0.22	1.6698	0.0106	2×10^{-4}	2×10^{-4}	-3×10^{-4}	
0.24	1.6804	0.0108	4×10^{-4}	-1×10^{-4}		
0.26	1.6912	0.0112	3×10^{-4}			
0.28	1.7024	0.0115				
0.30	1.7139					

$f(0.23) = 1.6596 + 0.0153 + 1.5\times10^{-4} + 1.25\times10^{-5} + 9.375\times10^{-6} + 8.203125\times10^{-6}$

$= \boxed{1.6750}$

(ii) $x = 0.29$, $h = 0.02$, $a = 0.30$, $u = -0.5$

$f(0.29) = 1.7139 + (-5.75\times10^{-3}) + (-3.75\times10^{-5}) + 6.25\times10^{-6} + (1.1718\times10^{-5}) + (1.91406\times10^{-5})$

$= \boxed{1.7081}$

8. In an examination, the number of candidates who obtained scores between certain limits are as follows:

Scores	*Number of candidates*
0—19	41
20—39	62
40—59	65
60—79	50
80—99	17

Estimate the number of candidates who obtained fewer than 70 scores.

less than 19	41	$a = 99$
less than 39	103	$h = 20$
less than 59	168	$x = 70$
→ less than 79	218	$u = -1.45$
less than 99	235	

x	y	Δy	$\Delta^2 y$	$\Delta^3 y$	$\Delta^4 y$
19	41				
		62			
39	103		3		
		65		−18	
59	168		−15		0
		50		−18	
79	218		−33		
		17			
99	235				

$$f(70) = 235 + (-24.65) + (-10.76625) + (-1.0766)$$

$$= 198.50715$$

12. Using Newton's backward difference formula, find the value of $e^{-1.9}$ from the following table of values of e^{-x}:

x:	1	1.25	1.50	1.75	2.00
e^{-x}:	0.3679	0.2865	0.2231	0.1738	0.1353

$a = 2.00$, $h = 0.25$, $x = 1.9$, $u = -0.4$

x	y	Δy	$\Delta^2 y$	$\Delta^3 y$	$\Delta^4 y$
1	0.3679				
		-0.0814			
1.25	0.2865		0.018		
		-0.0634		-3.9×10^{-3}	6×10^{-4}
1.50	0.2231		0.0141		
		-0.0493		-3.3×10^{-3}	
1.75	0.1738		0.0108		
		-0.0385			
2.00	0.1353				

$$f(1.9) = 0.1353 + 0.01544(-1.296 \times 10^{-3}) + (7.112 \times 10^{-4}) + (-2.4096 \times 10^{-5})$$

$$= 0.1495$$