

Sp 98

EGN 3420

Exam 2

Name _____

DO ANY THREE PROBLEMS!

NO SCRATCH WORK DONE ON PROBLEM PAGES!

ALL WORK DONE ON WORK SHEETS!

Check the 3 problems you want graded.

1 40 pts

2 35 pts

3 30 pts

4 25 pts

Problem 1 (40 pts)

A) Annual incomes (I) of individuals (after ten years of employment) and their years of education (N) are tabulated below. Label the additional columns and fill in the table with the values needed to find the normal equations for determining a_0 , a_1 and a_2 , the coefficients of the least squares quadratic. All numbers should be rounded to 4 places after the decimal point.

Least Squares Quadratic: $\hat{I} = a_0 + a_1N + a_2N^2$

	N_i	I_i	N_i^2	N_i^3	N_i^4	$N_i I_i$	$N_i^2 I_i$
1	0	12					
2	5	24					
3	8	33					
4	11	50					
5	16	84					
6	22	125					

B) Solve the normal equations to find a_0 , a_1 and a_2 . You may use your calculator.

Ans. $a_0 =$ _____, $a_1 =$ _____, $a_2 =$ _____

C) Fill in the table below to find the coefficient of determination r^2 .

i	N_i	I_i	$I_i - \bar{I}$	$(I_i - \bar{I})^2$	\hat{I}_i	e_i	e_i^2
1	0	12					
2	5	24					
3	8	33					
4	11	50					
5	16	84					
6	22	125					

Ans. $r^2 =$ _____

Problem 2 (35 pts)

- A) Find the equation of the 4th order Newton divided-difference interpolating polynomial that passes through the data points (x_i, y_i) , $i = 0, 1, 2, 3, 4$.
Fill in the portion of the table below needed to find the solution.

i	x_i	$y_i=f(x_i)$	Δ	Δ^2	Δ^3	Δ^4	Δ^5
0	0	1					
1	1	-1					
2	3	31					
3	4	137					
4	6	889					
5	7	1751					

Ans. $f_4(x) =$

- B) Estimate $f(x)$ when $x = 5$ by using $f_4(5)$.

Ans. Estimate of $f(5) = f_4(5) =$

- C) Estimate $R_4(5)$, the error in $f_4(5)$. Use $(7,1751)$ as the additional data point required to estimate the error. Fill in additional parts of the table as needed.

Ans. Estimate of $R_4(5) =$

Problem 3 (30 pts)

A quadratic spline is fit to 4 data points. The equation is given below.

$$f(x) = \left\{ \begin{array}{ll} x & 0 \leq x \leq 1 \\ ax^2 + bx + c & 1 \leq x \leq 2 \\ -3x^2 + 19x - 21 & 2 \leq x \leq 3 \end{array} \right\}$$

Find a, b, and c.

Ans. a = _____, b = _____, c = _____

Problem 4 (25 pts)

Estimate the definite integral $I = \int_0^p (1 + \sin x) dx$

A) Using Trapezoidal Integration with 10 equally spaced intervals.

B) Using Simpsons 1/3 Rule with 10 equally spaced intervals.

Fill in the following table to help with the calculations. Round all calculations and calculator display numbers to 4 places after the decimal. Remember to use radians when evaluating the trigonometric function.

i	x_i	f_i
0	0.0000	1.0000
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		

Ans. A) _____

B) _____