## THE OPEN UNIVERSITY OF SRILANKA

B.Sc/B.Ed. Degree Programme, Continuing Education Programme

OPEN BOOK TEST (OBT) - 2004/2005

EVEL 5 - APPLIED MATHEMATICS

AMU 3183/ AME 5183- NUMERICAL METHODS II



## DURATION: ONE AND HALF - HOURS

DATE: 27.08. 2005

TIME: 4.00 P.M - 5.30 P.M

## Answer all questions.

1.(a) By considering the limit of the three point Lagrangian interpolation formula relative to  $x_0$ ,  $x_0 + \varepsilon$  and  $x_1 + \varepsilon$  as  $\varepsilon \to 0$ , obtain the formula

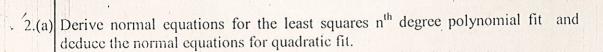
$$f(x) = \frac{(x_1 - x)(x + x_1 - 2x_0)}{(x_1 - x_0)^2} f(x_0) + \frac{(x - x_0)(x_1 - x)}{(x_1 - x_0)} f(x_0) + \frac{(x - x_0)^2}{(x_1 - x_0)^2} f(x_1) + E(x).$$
where  $E(x) = \frac{1}{6} (x - x_0)^2 (x - x_1) f^{(3)}(c)$ .

(b) The Dow Jones industrial index in 2001 is given in the following table. Find the polynomial of the lowest possible degree interpolating the data from March to May by applying Lagrange interpolation.

(c) Evaluate the polynomial to estimate the index in October. Comment on your results.

Month	January	February	March	April	May
Index	10600	11000	1.0400	9800	10800

June	July	August	September	October
11000	10500	10500	10000	8800



(b) Fit a curve of the form  $y = a_0 + a_1 x + a_2 x^2$  to the following data:

- 3.(a) The centered difference operator  $\delta$  is defined as  $\delta = E^{\frac{1}{2}} E^{-\frac{1}{2}}$ . Prove the following.
  - (i)  $\Delta = \delta E^{\frac{1}{2}}$  where  $\Delta$  is the forward difference operator...
  - (ii)  $\Delta = \frac{1}{2}\delta^2 + \delta\sqrt{1 + \frac{\delta^2}{4}}.$
  - (ii)  $E^{\frac{1}{2}} + E^{-\frac{1}{2}} = \frac{2+\Delta}{\sqrt{1+\Delta}} = \frac{2-\nabla}{\sqrt{1-\nabla}}$ , where  $\nabla$  is the backward difference operator.
  - (b) Estimate the order of the polynomial which might be suitable for the following function:
    - x: 2.0 2.1 2.2 2.3 2.4 2.5 2.6 2.7 f(x): 0.577 0.568 0.556 0.540 0.520 0.497 0.471 0.442

Find the values of f(2.5) and f(2.65) using suitable difference formulae.

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