İstanbul Kültür University
Department of Computer Engineering

MAT 002 - Numerical Methods
Fall 2011-2012

Final Exam

May 22, 2012

Number:

Name:

Directions – You have 110 minutes to complete the exam. Please do not leave the examination room in the first 30 minutes of the exam. There are five questions, of varying credit (100 points total). Indicate clearly your final answer to each question. You are allowed to use a calculator. During the exam, please turn off your cell phone(s). You cannot use the book or your notes. You have one page for "cheat-sheet" notes at the end of the exam papers. Do use the **radian mode** on your calculator when using the trigonometry buttons. Please use **five-decimal digit** in your calculations.

Good luck! *Emel Yavuz Duman, PhD.*

Question 1.		Question 4.	
Question 2.		Question 5.	
Question 3.		MARK	

Question 1. 15 *points*

From the following table, find the number of students who obtain less than 90 mark by using *Newton's Backward Difference Formula.*

Marks	$20-40$	$40-60$	$60-80$	$80-100$
Number of students	11	23	13	8

Answer.

Question 2. $5 + 15$ *points*

Consider the equation $e^x - x^2 + 3x - 2 = 0$.

(a) Find an interval $[a, b]$ which contains a root of this equation.
Answer.

(b) Calculate the fourth root approximation p_4, by using any root finding algorithm in the interval $[a, b]$ determined in (a).
Answer.

Question 3. 15 *points*

The function $f(x) = \sin x$ will be approximated at $x = \frac{\pi}{2}$ with the help of the third order *Lagrange interpolating polynomial* by using the nodes

$$x_0 = \frac{\pi}{2} - 2h, \quad x_1 = \frac{\pi}{2} - h, \quad x_2 = \frac{\pi}{2} + h, \quad x_3 = \frac{\pi}{2} + 2h.$$

If the involved error in this approximation will be less than 10^{-2}, calculate an upper bound for h.

Answer.

Question 4. $10 + 10 + 5$ *points*

Consider the definite integral $\int_1^3 \{(x+2)^4 + e^x\} dx$. It is desired to approximate it within 10^{-1} accuracy using the Composite Simpson's rule.

(a) Determine the possible smallest n value. Where n is the number of the subintervals.

Answer.

(b) Calculate the approximation by using the n value that you have found in (a).

Answer.

(c) Evaluate the actual error, is it less than 10^{-1}.

Answer.

Question 5. $10 + (10 + 5)$ *points*

(a) Use the most accurate three-point formula to determine $f'(3.1)$ in the following table.

x	3.0	3.1	3.2	3.3
$f(x)$	417.43	507.36	607.09	750.99

Answer.

(b) The data in (a) were taken from the function $f(x) = e^{2x} + x^2 + 5$. Compute the actual error in the approximation and also find an error bound for this approximation.

Answer.