İstanbul Kültür University
Department of Computer Engineering

MAT 002 - Numerical Methods
Fall 2011-2012

Second Midterm

Student ID _____

Name Surname _____

May 3, 2012

Directions – You have 115 minutes to complete the exam. Please do not leave the examination room in the first 30 minutes of the exam. There are seven 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. The answer key to this exam will be posted on Department of Mathematics and Computer Science board after the exam.

Good luck! *Emel Yavuz Duman, PhD.*

Question 1.		Question 5.	
Question 2.		Question 6.	
Question 3.		Question 7.	
Question 4.		TOTAL	

Question 1. 14 *points*

Consider the following table:

x_i	10	15	17
$f(x_i)$	35	10	14

Using the *Second Lagrange Interpolating Polynomial*, find the approximated solution of the equation $f(x) = 11$.

Answer.

Question 2. $12 + 3$ *points*

Use the *Newton's Forward Difference Formula* to approximate $\sqrt{5}$ with the function $f(x) = 5^x$ and the values $x_0 = -1$, $x_1 = 0$, $x_2 = 1$ and $x_3 = 2$. Also, compute the absolute error in this approximation.

Answer.

Question 3. $(4+4)+7$ *points*

(a) Approximate the integral

$$\int_1^{1.5} x^2 \ln x dx$$

using the *Trapezoidal and Simpson's rules.*

Answer.

Trapezoidal Rule:

Simpson's Rule:

(b) Find a bound for the error in the Trapezoidal rule approximation.

Answer.

Question 4. $7 + 7$ *points*

Approximate the integral

$$\int_0^3 e^{x^2} \tan x dx$$

(a) using the *midpoint rule*
Answer.

(b) using *Simpson's* 3/8 *rule*
Answer.

Question 5. $7 + 7$ *points*

Neville's method is used to approximate $f(0.5)$ as follows. Complete the table.

i	x_i	$Q_{i,0}$	$Q_{i,1}$	$Q_{i,2}$
0	0	0		
1	0.4	2.8	3.5	
2	0.7	**a**	**b**	27/7

Answer.

Question 6. $10 + 4$ *points*

Let we have the following table:

x_i	-5	7	11	18
$f(x_i)$	-195	273	1261	5762

(a) Use *Newton's Divided Difference method* to obtain the third order interpolating polynomial $P_3(x)$.
Answer.

(b) Use $P_3(x)$ in (a) to approximate $f(0)$.
Answer.

Question 7. $7 + 7$ *points*

Suppose you are given the data in the following table:

x_i	-0.10	0.05	0.10	0.20	0.25	0.35	0.40	0.50	0.65
$f(x_i)$	29.91	30.053	30.11	30.24	30.323	30.473	30.56	30.75	31.073

(a) Find the *best approximation value* for $f'(0.5)$ using the *three point formula.*
Answer.

(b) Find the *best approximation value* for $f'(0.5)$ using the *five point formula.*
Answer.