



**İ s t a n b u l K ü l t ü r U n i v e r s i t y**  
*Department of Computer Engineering*

MAT 002 - NUMERICAL METHODS  
Spring 2010-2011

*Second Midterm*

April 26, 2011

Number:

Name:

**Directions**

- You have 120 minutes to complete the exam. Please do not leave the examination room in the first 30 minutes of the exam. There are six questions with 20 points. **Do 5 of 6 questions** (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 double-sided 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 2.	
Question 3.	

Question 4.	
Question 5.	
Question 6.	

**MARK** -----

**Question 1.**10 + 10 *points*

Suppose that we have values  $\ln 1 = 0$ ,  $\ln 2 = 0.69315$ ,  $\ln 3 = 1.0986$ . Give a formula for an interpolation estimate of  $\ln 2.5$  and estimate how large the error could be.

**Answer.**

**Question 2.**10 + 10 *points*

Evaluate  $\int_0^2 e^{-x} dx$ , with  $h = 0.5$  using suitable numerical integration formula. Also compute the error bound for this approximation.

**Answer.**

**Question 3.**

5 + 5 + 5 + 5 points

Neville's method is used to approximate  $f(0.5)$ , giving the following table

$i$	$x_i$	$f(x_i) = Q_{i,0}$	$Q_{i,1}$	$Q_{i,2}$	$Q_{i,3}$
0	-2	0.25			
1	-1	0.50	0.875		
2	0	<b>a</b>	1.250	<b>c</b>	
3	1	2.00	<b>b</b>	1.4375	<b>d</b>

Complete the missing entries.

**Answer.**

**Question 4.**

10 + 10 points

Consider the following table

$x_i$	1	2	3	4
$f(x_i)$	3.6	1.8	1.2	0.9

Construct Newton's divided difference table for the tabulated function. Also, compute the third order Newton interpolating polynomial at 2.5

**Answer.**

$i$	$x_i$	$f[x_i]$	$f[x_{i-1}, x_i]$	$f[x_{i-2}, x_{i-1}, x_i]$	$f[x_{i-3}, x_{i-2}, x_{i-1}, x_i]$
0	1	3.6			
1	2	1.8			
2	3	1.2			
3	4	0.9			

**Question 5.**10 + 10 *points*

Evaluate the integral  $\int_0^1 (x + e^{2x}) dx$  using open Newton-Cotes formula for  $n = 2$ . Also compute the error bound for this approximation.

**Answer.**

**Question 6.**

5 + 5/5 + 5 points

Consider the following table

$x_i$	0.2	0.4	0.6	0.8	0.9	1.0	1.1	1.2	1.4
$f(x_i)$	0.39	1.08	1.49	1.78	1.89	2.00	2.10	2.18	2.34

- (a) Find the best approximation value of  $f'(1.0)$  using three point formula. Also it is given that the table in this question were taken from the function  $f(x) = \ln x + 2$ . Compute the actual error in the approximation.
- (a) Repeat the part (a) for five point formula.

**Answer.**