



2012-2013 Fall Term
MAT 202E
NUMERICAL METHODS

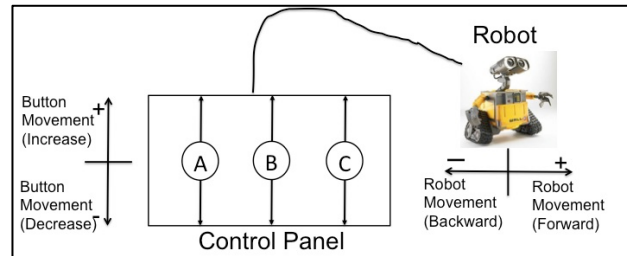
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MIDTERM EXAM

- 1) (10 pts) For the conversions given below, perform the operations step by step.
 - a. (5 pts) $(160,343)_{10} = (?)_2$
 - b. (5 pts) $(11001,1001)_2 = (?)_{10}$
- 2) (5 pts) Represent $-5,5834 \times 10^{10}$ as a single precision floating point number using IEEE-754 format.

- 3) (30 pts) A control panel embedded into a robot's movement unit is illustrated in the figure. It is composed of three buttons; A, B and C. These buttons are used to move the robot to the forward or backward directions. Three experiments are performed to analyze the movement of the robot.



The Experiments:

→ If B is increased by +2 and C increased by +1, the robot moves 8 step backwards.

→ If A is increased by +1, B is decreased by -2 and C is decreased by -3, the robot does not move.

→ If A is decreased by -1, B is increased by 1 and C is increased by 2, the robot moves 3 steps forward.

- According to the experiments;
- a) (7 pts) Write the linear system model of the control panel.
 - b) (15 pts) Solve the linear system by Naïve Gaussian Elimination method.
 - c) (8 pts) Write the pseudo-code of the forward-elimination phase for the algorithm.

- 4) (30 pts) Given the experimental data below, answer the following questions, by using the Newton's Divided Difference Method:
 - a) (6 pts) Draw the divided difference table for degree 3.
 - b) (11 pts) Estimate $f(0,3)$.
 - c) (13 pts) It is discovered that $f(0,4)$ is underestimated by 10 and $f(0,6)$ is overestimated by 5. Under these new circumstances, by what amount (in percentage) the estimation of $f(0,3)$ found in question-b is changed?

x	0,0	0,2	0,4	0,6
f(x)	15	21	30	51

- 5) (25 pts) A loan of A Turkish Lira (TL) is repaid by making n equal monthly payments of M TL, starting a month after the loan is made. It can be shown that if the monthly interest rate is r , then

$$Ar = M \left(1 - \frac{1}{(1+r)^n} \right).$$

- a) (20 pts) A car loan of 10000 TL was repaid in 60 monthly payments of 250 TL. Use the Newton-Raphson Method to find the monthly interest rate with the absolute relative approximate error smaller than %0,0019.
- b) (5 pts) Write the pseudo-code for the algorithm.

-Duration: 120 minutes