Prince of Songkla University
Faculty of Engineering

Final Test
20 February 2012
215-274 Numerical Methods for Mechanical Engineering

Semester 2/2012
09:00-12:00
Room: S101, S203

Name _____ ID _____

Direction:
1. All types of calculator, and dictionary are permitted.
2. There are totally 4 problems.
3. One sheet of hand-written A4 paper is allowed. No photocopy!!

Perapong Tekasakul
Kittinan Maliwan

Instructors

Problem No.	**Full score**	**Your mark**
1	10	
2	20	
3	15	
4	15	
Total	**60**	

1. Solve the following problem numerically from $t=0$ to 3:

$$\frac{dy}{dt}=-y+t^2 \qquad y(0)=1$$

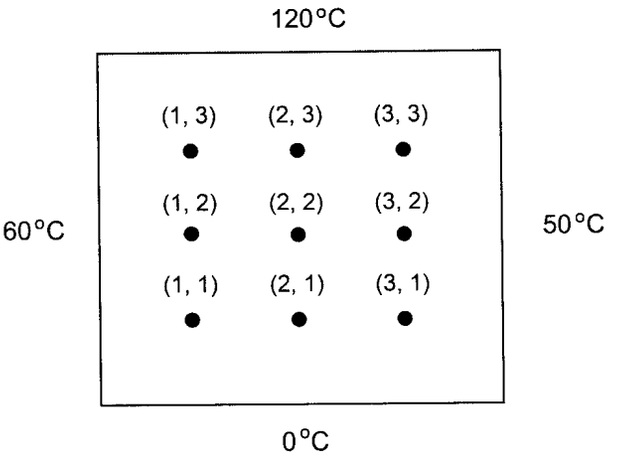
Use the third-order RK method with a step size of 0.5.

2. Use the shooting method to solve

$$\frac{d^2y}{dx^2}-2y=8x(9-x)$$

Obtain a solution for boundary conditions: $y(0)=0$ and $y(9)=0$ with a step size of 3. Use Euler method to solve the 1st-order ODEs obtained from the 2nd-order ODE. First, guess $z(0)=y'(0)=4$ and then guess $z(0)=y'(0)=-24$.

3. Use Liebmann's method to solve for the temperature of the square heated plate in the figure. Use a relaxation factor of 1.2, iterate twice and determine approximate error at each node.



4. Use the simple implicit method to solve for the temperature distribution of a long, thin rod with a length of 10 cm and the following values: $k'=0.49$ cal/(s· cm °C), $\Delta x=2$ cm, and $\Delta t=0.1$ s. At $t=0$, the temperature of the rod is zero and the boundary conditions are fixed at $T(0)=100°\text{C}$ and the derivative at $x=10$ is equal to zero for all time. Note that the rod is aluminum with $C=0.2174$ cal/$(g.^\circ\text{C})$ and $\rho=2.7g/\text{cm}^3$. Therefore, $k=0.49/(2.7\cdot 0.2174)=0.835$ cm^2/s and $\lambda=0.835(0.1)/(2)^2=0.020875$.