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 Rank/Grade  
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 ON 4582 ASS

$U_x = U_{xx}$  for  $0 \leq x \leq 1$ ,  $0 \leq t \leq 0.1$ ,  $\Delta x = 0.2$   
 $= U_x - U_{xx}$

Initial Condition  
 $u(x,0) = x^2 k = f(x)$

Boundary Condition  
 $u(0,t) = 0$   $\rightarrow U(1,t) = 1k$

At  $t=0$   
 $U_{x,0} = 0^2 k$  when  $x=0.2$   $U_{x,0} = (0.2)^2 = 0.0016$   
 when  $x=0.4$   $U_{x,0} = (0.4)^2 = 0.0056$   
 when  $x=0.6$   $U_{x,0} = (0.6)^2 = 0.0036$

Using Euler mth  
 $U_{i,j+1} = rU_{i,j} + (1-2r)U_{i,j} + rU_{i+1,j}$   
 where  $r = \frac{\Delta t}{\Delta x^2} = \frac{0.02}{(0.2)^2} = 0.5$

Evaluating  $U$  at  $t=0.02$   $i,j = 0,1,2,3,4,5$

at  $i=0$   
 $U_{0,1} = 0$   
 $U_{1,1} = rU_{0,0} + (1-2r)U_{1,0} + rU_{2,0}$   
 $= 0.5(0) + [1-2(0.5)](0.0016) + 0.5(0.0056)$   
 $= 0.0128$

at  $i=2$   
 $U_{2,1} = rU_{1,0} + (1-2r)U_{2,0} + rU_{3,0}$   
 $= 0.5(0.0056) + [1-2(0.5)](0.0036) + 0.5(0.0096)$   
 $= 0.0128$

at  $i=4$   
 $U_{4,1} = rU_{3,0} + (1-2r)U_{4,0} + rU_{5,0}$   
 $= 0.5(0.0036) + [1-2(0.5)](0.0016) + 0.5(0.0056)$   
 $= 0.0128$

$U_{0,1} = 0$ ,  $U_{1,1} = 0.0128$ ,  $U_{2,1} = 0.0128$ ,  $U_{3,1} = 0.0128$ ,  $U_{4,1} = 0.0128$

Evaluating  $U$  at  $t=0.04$   $i,j = 1$

at  $i=1$   
 $U_{1,2} = rU_{0,1} + (1-2r)U_{1,1} + rU_{2,1}$   
 $= 0.5(0) + (1-2(0.5))(0.0128) + 0.5(0.0128)$   
 $= 0.0064$

at  $i=3$   
 $U_{3,2} = rU_{2,1} + (1-2r)U_{3,1} + rU_{4,1}$   
 $= 0.5(0.0128) + [1-2(0.5)](0.0128) + 0.5(0.0128)$   
 $= 0.0064$

at  $i=3$   
 $U_{3,2} = rU_{2,1} + (1-2r)U_{3,1} + rU_{4,1}$   
 $= 0.5(0.0128) + [1-2(0.5)](0.0128) + 0.5(0.0128)$   
 $= 0.0064$   
 $U_{3,2} = 0$   $U_{3,2} = 1$

$U$  at  $t=0.06$   $i,j = 2$   
 ①  $U_{1,3} = rU_{0,2} + (1-2r)U_{1,2} + rU_{2,2}$   
 $= 0.5(0) + (1-2(0.5))(0.0064) + 0.5(0.0064)$   
 $= 0.0032$   
 ②  $U_{3,3} = rU_{2,2} + (1-2r)U_{3,2} + rU_{4,2}$   
 $= 0.5(0.0064) + [1-2(0.5)](0.0064) + 0.5(0.0064)$   
 $= 0.0032$   
 $U_{3,3} = 0$  and  $U_{3,3} = 1$

$U$  at  $t=0.08$   $i,j = 3$  where  $U_{0,4} = 0$  and  $U_{5,4} = 1$   
 $U_{1,4} = rU_{0,3} + (1-2r)U_{1,3} + rU_{2,3}$   
 $= 0.5(0) + (1-2(0.5))(0.0032) + 0.5(0.0032)$   
 $= 0.0016$   
 $U_{3,4} = rU_{2,3} + (1-2r)U_{3,3} + rU_{4,3}$   
 $= 0.5(0.0032) + [1-2(0.5)](0.0032) + 0.5(0.0032)$   
 $= 0.0016$

$U$  at  $t=0.1$   $i,j = 4$  where  $U_{0,5} = 0$  and  $U_{5,5} = 1$   
 $U_{1,5} = rU_{0,4} + (1-2r)U_{1,4} + rU_{2,4}$   
 $= 0.5(0) + (1-2(0.5))(0.0016) + 0.5(0.0016)$   
 $= 0.0008$   
 $U_{3,5} = rU_{2,4} + (1-2r)U_{3,4} + rU_{4,4}$   
 $= 0.5(0.0016) + [1-2(0.5)](0.0016) + 0.5(0.0016)$   
 $= 0.0008$

| $T^2$ | 0 | 0.2    | 0.4    | 0.6    | 0.8    | 1 |
|-------|---|--------|--------|--------|--------|---|
| 0     | 0 | 0.0016 | 0.0056 | 0.0036 | 0.0016 | 1 |
| 0.02  | 0 | 0.0128 | 0.0128 | 0.0128 | 0.0128 | 1 |
| 0.04  | 0 | 0.0064 | 0.0064 | 0.0064 | 0.0064 | 1 |
| 0.06  | 0 | 0.0032 | 0.0032 | 0.0032 | 0.0032 | 1 |
| 0.08  | 0 | 0.0016 | 0.0016 | 0.0016 | 0.0016 | 1 |
| 1     | 0 | 0.0008 | 0.0008 | 0.0008 | 0.0008 | 1 |