OKPALA CHRISTOPHER CHIBUEZE

17/ENG02/068

COMPUTER ENGINEERING ENG 382

$u_t = C u_{xx} = 0$

$\frac{du}{dt} = C \frac{d^2u}{dx^2} = 0$

$\frac{du}{dt} = \frac{C d^2u}{dx^2}$

$\frac{u_{i,j+1} - u_{i,j}}{\Delta t} = C \cdot \frac{u_{i+1,j} - 2u_{i,j} + u_{i-1,j}}{\Delta x^2}$

$u_{i,j+1} - u_{i,j} = C \frac{\Delta t}{\Delta x^2} [u_{i+1,j} - 2u_{i,j} + u_{i-1,j}]$

$U[x,0] = x^4$ k

$\Delta x = 0.2$ m, $\Delta t = 0.02$ day

for initial conditions

At $x = 0 \longrightarrow x^4 = 0$

At $x = 0.2 \longrightarrow 0.2^4 = 1.6 \times 10^{-3}$

At $x = 0.4 \longrightarrow 0.4^4 = 0.0256$

At $x = 0.6 \longrightarrow 0.6^4 = 0.1296$

At $x = 0.8 \longrightarrow 0.8^4 = 0.4096$

At $x = 1 \longrightarrow 1^4 = 1$

$u_{i,j+1} = u_{i,j} + r[u_{i+1,j} - 2u_{i,j} + u_{i-1,j}]$

$u_{i,j+1} = r u_{i-1,j} + (1-2r) u_{i,0} + r u_{i+1,j}$

When $i = 1$, $j = 0$

$u_{1,1} = 0.5 u_{0,0} + 0.5 u_{2,0}$

$= (0.5(0) + 0.5)(0.0256)$

$u_{1,1} = 0.0128$

When $i = 2$, $j = 0$

$u_{2,1} = 0.5(u_{1,0}) + 0.5(u_{3,0})$

$= 0.5(1.6 \times 10^{-3}) + 0.5(0.1296)$

$u_{2,1} = 0.0656$

when $i=3$ $j=0$ $\Rightarrow U_{3,1} = 0.5(U_{2,0}) + 0.5(U_{4,0})$

$= 0.5(0.0256) + 0.5(0.4096)$

$U_{3,1} = 0.217$

when $i=3$, $j=0$ $\Rightarrow U_{4,1} = 0.5(U_{3,0}) + 0.5(U_{5,0})$

$= 0.5(0.0256) + 0.5(0.4096)$

$U_{4,1} = 0.5648$

for $j=1$

when $i=1$ $U_{1,2} = 0.5(0.1) + 0.5(U_{2,1})$

$= 0.5U_{0,1} + 0.5U_{2,1} = 0 + 0.5(0.0656)$

$U_{1,2} = 0.0328$

when $i=2$ $\therefore$ $U_{2,2} = 0.5(U_{1,1}) + 0.5(U_{3,1})$

$= 0.5(0.0128) + 0.5(0.217)$

$U_{2,2} = 0.1152$

when $i=3$ $\therefore$ $U_{3,2} = 0.5(U_{0,1}) + 0.5(U_{4,1})$

$= 0.5(0.0656) + 0.5(0.5648)$

$U_{3,2} = 0.3152$

when $i=4$ $\therefore$ $U_{4,2} = 0.5(U_{2,1}) + 0.5(U_{5,1})$

$= 0.5(0.2176) + 0.5(1)$

$U_{4,2} = 0.6088$

For $j=2$

when $i=1$ $\therefore$ $U_{1,3} = 0.5(U_{0,1}) + 0.5(U_{2,2})$

$= 0 + 0.5(0.1152) = 0.0576$

when $i=2$ $\therefore$ $U_{2,3} = 0.5(U_{0,1}) + 0.5(U_{2,2})$

$= 0.5(0.0328) + 0.5(0.3152) = 0.174$

when $i=3$ $\therefore$ $U_{3,3} = 0.5(U_{2,2}) + 0.5(U_{4,2})$

$= 0.5(0.1152) + 0.5(0.6088) = 0.362$

0.362

when $i=4$ $\therefore U_{4,3} = 0.5(U_{3,2}) + 0.5(U_{5,2})$

$= 0.5(0.3152) + 0.5(\,)$

$U_{4,3} = 0.6576$

For $j=3$

when $i=1$ $U_{1,4} = 0.5(U_{0,3}) + 0.5(U_{2,3})$

$= 0.5(0) + 0.5(0.174) 0.084$

when $i=2$ $\therefore U_{2,4} = 0.5(U_{1,3}) + (0.5(U_{3,3})$

$= 0.5(0.0576) + 0.5(0362) = 0.2098$

when $i=3$ $U_{3,4} = 0.5(U_{2,3}) + 0.5(U_{4,3})$

$= 0.5(0.174) + 0.5(0.6576) = 0.4158$

when $i=4$ $\therefore U_{4,4} = 0.5(U_{3,3}) + 0.5(U_{5,3})$

$= 0.5(0.362 + 0.5(1)$

$= 0.681$

For $j=4$

when $i=1$ $U_{1,5} = 0.5(U_{0,4}) + 0.5(U_{2,4})$

$= 0.5(0.2098) = 0.1049$

when $i=2$ $U_{2,5} = 0.5(U_{1,4}) + 0.5(U_{3,4})$

$= 0.5(0.087) + 0.5(0.4158) = 0.251$

when $i=3$ $U_{3,5} = 0.5(U_{2,4}) + 0.5(U_{4,4})$

$= 0.5(0.2098) + 0.5(0.681)$

$= 0.4454$

when $i=4$ $U_{4,5} = 0.5(U_{3,4}) + 0.5(U_{5,4})$

$= 0.5(0.4158) + 0.5(1)$

$= 0.7079$

									0.5
	0.1	0	0.1049	0.2514	0.4454	0.7079	1		
	0.08	0	0.087	0.2098	0.4158	0.681	1		
	0.06	0	0.0576	0.174	0.362	0.6576	1		
	0.04	0	0.0328	0.1152	0.3152	0.6088	1		
	0.02	0	0.0128	0.0656	0.2176	0.5648	1		
	0	0	0.0016	0.0256	0.1296	0.4096	1		
		0	0.2	0.4	0.6	0.8	1