IDARA INUMBONG EMK
17/ENG02/025
ASSIGNMENT VI

$U_t = \alpha U_{xx} = 0$

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

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

$\frac{U_{i,j+1} - U_{i,j}}{\Delta t} = \frac{(U_{i+1,j} - 2U_{i,j} + U_{i-1,j})}{\Delta x}$

$U_{i,j+1} - U_{i,j} = (\frac{\Delta t}{\Delta x^2}(U_{i+1,j} - 2U_{i,j} + U_{i-1,j}] \cdot [$

$= \Delta t / \Delta x^2 ; \quad C = 1$

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

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

for initial conditions

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

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

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

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

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

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

$\therefore U_{i,j+1} = U_{i,j} + \Gamma[U_{i+1,j} - 2U_{i,j} + U_{i-1,j}]$

$U_{i,j+1} = \Gamma(U_{i-1,j} + (1-2\Gamma)U_{i,j} + \Gamma U_{i+1,j} \quad \text{---} x$

when $i = 1, j = 0$

$U_{1,1} = 0.5 U_{0,0} + 0.5 U_{0,0}$

$0.5(0) + 0.5(0.0256)$

$U_{1,1} = 0.0128$

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 $i = 3, j = 0$

$$U_{3,1} = 0.5(U_{2,0}) + 0.5(U_{4,0})$$
$$= 0.5(0.0256) + 0.5(0.4096)$$
$$U_{3,1} = 0.2176$$

when $i = 4, j = 0$

$$U_{4,1} = 0.5(U_{3,0}) + 0.5(U_{3,0})$$
$$= 0.5(0.0256) + 0.5(0.4096)$$
$$U_{4,1} = 0.5648$$

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 $i = 2$

$$U_{1,2} = 0.5(U_{1,1}) + 0.5(U_{4,1})$$
$$0.5(0.0328) + 0.5(0.2176)$$
$$U_{2,2} = 0.1152$$

when $i = 3$

$$U_{3,2} = 0.5(U_{0,1}) + 0.5(U_{4,1})$$
$$0.5(0.0656) + 0.5(0.5648)$$
$$U_{3,2} = 0.3152$$

when $i = 4$

$$U_{4,2} = 0.5(U_{2,1}) + 0.5(U_{5,1})$$
$$= 0.5(0.2176) + 0.5(1)$$
$$U_{4,2} = 0.6088$$

For $T=2$

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 $i=2$

$$U_{2,3} = 0.5(U_{1,2}) + 0.5(U_{3,2})$$
$$0.5(0.0328) + 0.5(0.3152) = 0.174$$

when $i=3$

$$U_{3,3} = 0.5(U_{2,2}) + 0.5(U_{4,2})$$
$$0.5(0.1152) + 0.5(0.0088) =$$
$$= 0.362$$

when $i=4$

$$U_{4,3} = 0.5(U_{3,2}) + 0.5(5,2)$$
$$0.5(0.3152) + 0.5(1)$$
$$U_{4,3} = 0.6576$$

For $T=3$

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 $i=2$

$$U_{2,4} = 0.5(1,3) + 0.5(U_{3,3})$$
$$0.5(0) + 0.5(0.6576)$$
$$= 0.4158$$

when $i=3$

$$U_{3,4} = 0.5(U_{2,3}) + 0.5(U_{4,3})$$
$$0.5(0.174) + 0.5(0.6576)$$
$$= 0.41$$

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

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

$0.5(0.0576) + 0.5(0.362)$

$= 0.2098$

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

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

$0.5(0.362) + 0.5(1)$

$= 0.681$

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

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

$0.5(0.087) + 0.5(0.4158)$

$= 0.2514$

when i = 3

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

$0.5(0.2098) + 0.5(0681)$

0.4454

When i = 4

$$u_{4,5} = 0.5(u_{3,4}) + 0.5(u_{3,4})$$
$$0.5(0.14158) + 0.5(1)$$
$$= 0.7079$$

Δt	J/Temp(K)			
0.1	5	0	0.1049	0.2514
0.08	4	0	0.087	0.2098
0.06	3	0	0.2576	0.174
0.04	2	0	0.0328	0.1152
0.02	1	0	0.0128	0.0656
0	0	0	0.0016	0.028
Δx		0	0.2	0.4
	L	0	1	2

0.9454	0.7079	1
0.4158	0.681	1
0.362	0.6576	1
0.3152	0.6008	1
0.2176	0.5648	1
0.1296	0.4098	1
0.6	0.8	1
3	4	5