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

$= 0.5(0.362) + 0.5(1)$

$U_{4,4} = 0.681$

for $J=4$,

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

$= 0 + 0.5(0.2098)$

$U_{1,5} = 0.1049$

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

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

$U_{2,5} = 0.2514$.

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

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

$U_{3,5} = 0.4454$

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

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

$U_{4,5} = 0.7079$.

Δt	J/temp(k)						
0.1	5	0	0.1049	0.2514	0.4454	0.7079	1
0.08	4	0	0.087	0.2098	0.4158	0.681	1
0.06	3	0	0.0576	0.174	0.362	0.6576	1
0.04	2	0	0.0328	0.1152	0.3152	0.6008	1
0.02	1	0	0.0128	0.0656	0.2176	0.5648	1
0	0	0	0.0016	0.028	0.1296	0.4096	1
Δx		0	0.2	0.4	0.6	0.8	1
	i	0	1	2	3	4	5

$U_{4,2} = 0.5(U_{3,1}) + 0.5(U_{5,1})$
$= 0.5(0.2176) + 0.5(1)$
$U_{4,2} = 0.6088$

for $j = 2$,
when $i = 1$, $U_{1,3} = 0.5(U_{0,2}) + 0.5(U_{2,2})$
$= 0 + 0.5(0.1152)$
$U_{1,3} = 0.0576$

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

when $i = 3$, $U_{3,3} = 0.5(U_{2,2}) + 0.5(U_{4,2})$
$= 0.5(0.1152) + 0.5(0.6088)$
$U_{3,3} = 0.362$

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

0656)

for $j = 3$,
when $i = 1$, $U_{1,4} = 0.5(U_{0,3}) + 0.5(U_{2,3})$
$= 0.5(0) + 0.5(0.174)$
$U_{1,4} = 0.084$

6)

when $i = 2$, $U_{2,4} = 0.5(U_{1,3}) + 0.5(U_{3,3})$
$= 0.5(0.0576) + 0.5(0.362)$
$U_{2,4} = 0.2098$

8)

when $i = 3$, $U_{3,4} = 0.5(U_{2,3}) + 0.5(U_{4,3})$
$= 0.5(0.174) + 0.5(0.6576)$
$U_{3,4} = 0.4158$

when $i = 2, j = 0,$

$$U_{2,1} = 0.5(U_{1,0}) + 0.5(U_{3,0})$$
$$= 0.5(1.6 \times 10^{-2}) + 0.5(0.1296)$$
$$U_{2,1} = 0.0656$$

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 $i = 4, j = 0,$

$$U_{4,1} = 0.5(U_{3,0}) + 0.5(U_{5,0})$$
$$= 0.5(0.1296) + 0.5(1)$$
$$U_{4,1} = 0.5648$$

for $j = 1,$

when $i = 1,$

$$U_{1,2} = 0.5(U_{0,1}) + 0.5(U_{2,1})$$
$$= 0.5(0) + 0.5(0.0656)$$
$$U_{1,2} = 0.0328$$

when $i = 2,$

$$U_{2,2} = 0.5(U_{1,1}) + 0.5(U_{3,1})$$
$$= 0.5(0.0128) + 0.5(0.2176)$$
$$U_{2,2} = 0.1152$$

when $i = 3,$

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

when $i = 4,$

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Solution

$$U_t - C U_{xx} = 0$$

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

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

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

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

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

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

for initial conditions,

at $x = 0$, $x^4 = 0$
at $x = 0.2$, $x^4 = 1.6 \times 10^{-3}$
at $x = 0.4$, $x^4 = 0.0256$
at $x = 0.6$, $x^4 = 0.1296$
at $x = 0.8$, $x^4 = 0.4096$
at $x = 1.0$, $x^4 = 1$

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

$$U_{i,j+1} = rU_{i-1,j} + (1-2r)U_{i,j} + rU_{i+1,j}$$

when $i = 1, j = 0$,

$$U_{1,1} = 0.5(U_{0,0}) + 0.5U_{2,0}$$
$$= 0.5(0) + 0.5(0.0256)$$
$$U_{1,1} = 0.0128$$