Tutorial 3 Total 10 marks

Question 1 (1 mark)

Create a folder called Tutorial_3 on the server (or on your machine) as per previous weeks.

Question 2 (3 marks)

Write a C code which performs the compute shown in the flowchart shown on the next page. Save your code as Tutorial_3a.c. Your code should save the values contained within the array **a** to file upon completion.

Question 3 (4 marks)

Rewrite the code written for Question 2 using OpenMP to split the work across P = 8 processors. Save your code as Tutorial_3b.c in the directory Tutorial_3 you created in Question 1.

Question 4 (2 marks)

Prove that the two dimensional heat transfer equation, written as:

$$\frac{dT}{dt} - \frac{d}{dx}\left(\alpha\frac{dT}{dx}\right) - \frac{d}{dy}\left(\alpha\frac{dT}{dy}\right) = 0$$

can be written in the discretized form:

$$\frac{T_{i,j}^{k+1} - T_{i,j}^{k}}{\Delta t} - \alpha\left(\frac{T_{i+1,j}^{k} + T_{i-1,j}^{k} - 2T_{i,j}^{k}}{\Delta x^2}\right) - \alpha\left(\frac{T_{i,j+1}^{k} + T_{i,j-1}^{k} - 2T_{i,j}^{k}}{\Delta y^2}\right) = 0$$

(Show me your proof for credit)

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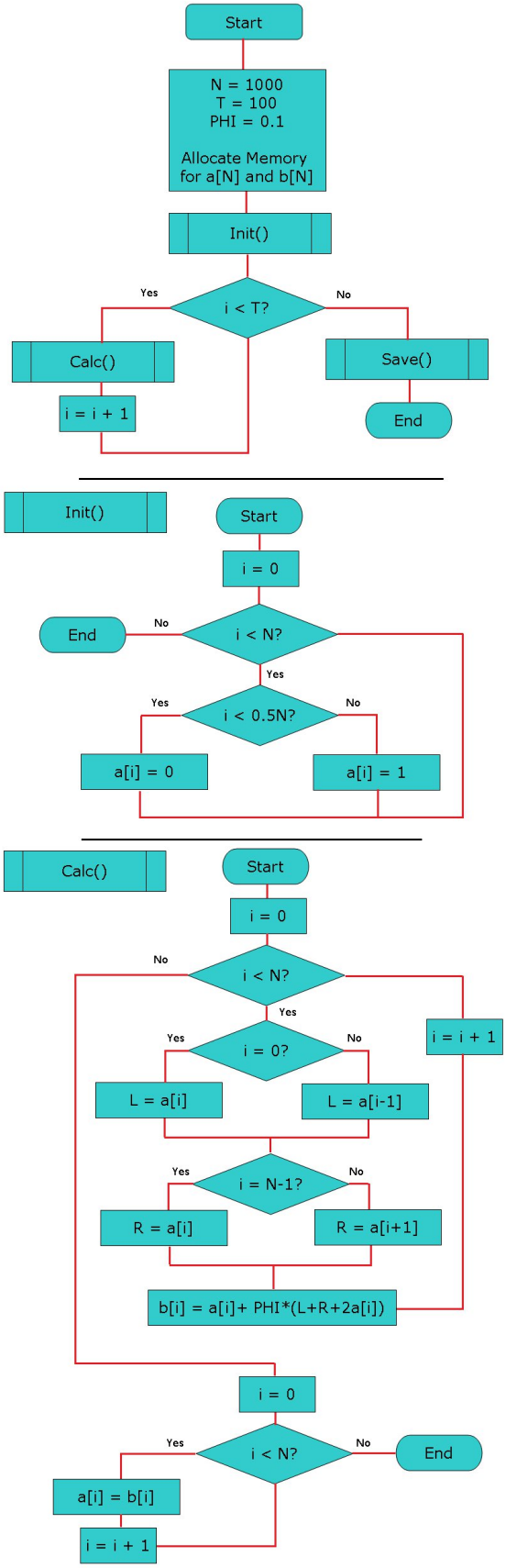
Start
N = 1000
T = 100
PHI = 0.1
Allocate Memory for a[N] and b[N]
Init()
i < T?
Yes
No
Calc()
Save()
i = i + 1
End
Init()
Start
i = 0
End
No
i < N?
Yes
i < 0.5N?
Yes
No
a[i] = 0
a[i] = 1
Calc()
Start
i = 0
No
i < N?
Yes
i = 0?
Yes
No
i = i + 1
L = a[i]
L = a[i-1]
i = N-1?
Yes
No
R = a[i]
R = a[i+1]
b[i] = a[i]+ PHI*(L+R+2a[i])
i = 0
i < N?
Yes
No
End
a[i] = b[i]
i = i + 1

Flowchart 1