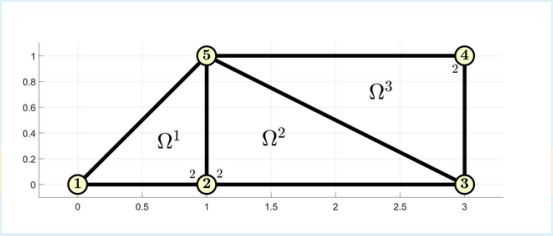
P1

Consider the Poisson heat diffusion on the domain shown above with the three triangular finite elements, nodes and local and global numbering plotted there. We consider that the thermal conductivity is $k_c = 4$ and the density of internal heating is $f = 3$. Also a fixed temperature $T = T_0$ is applied on all the bottom boundary, while a convection of coefficient $\beta = 6.00$ and bulk temperature T_∞ is present on the right boundary

(a) (1 point) The second shape function of the third element $\psi_2^3(x, y)$ is



- x/2 + y - 3/2
- 1 - y
- 3/2 - x/2
- x + y/2 - 3/2
- Leave it empty (no penalty) ✖

La resposta correcta és: x/2 + y - 3/2

(b) (1 points) The value of K_{52}, the $(5, 2)$ entry of the global stiff matrix K is

- -6
- 2
- -4
- -2
- Leave it empty (no penalty) ✖

La resposta correcta és: -6

Hint2:the value of K_{34} is -4.0000e+00

(c) (2 points) The value of F_5, the global internal heating of global node 5 is

- 2.5e+00
- 2.6e+00
- 2.3e+00
- 3.0e+00
- Leave it empty (no penalty) ✖

La resposta correcta és: 2.5e+00

Hint3:the value of F_1 is 5.0000e-01

(d) (2 points) Now suppose that a linear flow q_n on the edge between nodes1 and 5 of values $q_0 = 30$ and 0 respectively is applied. Then the value of Q_{33}^1 is

- 7.0711e+00
- 1.2294e+01
- 8.1983e+00
- 7.7762e+00
- Leave it empty (no penalty) ✖

La resposta correcta és: 7.0711e+00

(e) (2 points) When computing Q_4 as part of a convective edge, the expression relating T_3, T_4, T_∞ is

- $(-1)T_3 + (-2)T_4 + (3)T_\infty$
- $(-2)T_3 + (-1)T_4 + (1)T_\infty$
- $(1)T_3 + (-1)T_4 + (4)T_\infty$
- $(-3)T_3 + (0)T_4 + (2)T_\infty$
- Leave it empty (no penalty)

La resposta correcta és: $(-1)T_3 + (-2)T_4 + (3)T_\infty$

(f) (2 points) Now suppose that $T_0 = 0$ on all the bottom boundary and also $q_n = 0$ on the top edge joining nodes 4 and 5, besides the boundary conditions already done. The value of T_4, when $T_\infty = 0$ and T_5 is 1.4166e+00 is

- 3.4523e-01
- 1.0009e-01
- 5.8898e-01
- 4.2950e-01
- Leave it empty (no penalty) ✖

La resposta correcta és: 3.4523e-01