```
1   import StandardLibrary as STDLIB
2   import StandardMaterialsLibrary as STDMTLLIB
3   import postProcess as POSTPRO
4   import csv
5   import numpy as np
6   from numpy.linalg import inv
7
8   # The name of the input file
9   input_file = 'Beam_bending.sinp'
10  name_ip_file = input_file[:-5]
11
12  # Read entire input file
13  all_lines = STDLIB.readFile(input_file)
14
15  # Parse the input file for 'keywords'
16  [keyword_info,all_keywords,all_keywords_line_nos,comment_lines,all_asterix] =
    STDLIB.parseKeywords(input_file)
17
18  # Read the Nodes
19  Nodes = STDLIB.readNodes(all_lines,keyword_info,all_keywords_line_nos,all_asterix)
20
21  # Read the elements
22  Elements = STDLIB.readElements(all_lines,keyword_info,all_keywords_line_nos,all_asterix)
23
24  # Count the number of nodes
25  nnd = len(Nodes)
26  nel = len(Elements)
27
28  # Number of nodes per element
29  nne = 4
30
31  # Number of degrees of freedom per node
32  nodof = 2
33
34  # Number of degrees of freedom per element
35  eldof = nne*nodof
36
37  # --------
38  # Material
39  # --------
40
41  # Elastic Modulus in MPa
42  E = 2.8e+07;
43
44  # Poisson's ratio
45  nu = 0.3;
46
47  # Beam thickness in mm
48  thick = 5.0;
49
50  # Number of sampling points
51  num_gauss_points = 2;
52
53  # Form the elastic matrix for plane stress
54  dee = STDMTLLIB.formdsig(E,nu)
55
56  # --------------------
57  # Boundary conditions
58  # --------------------
59
60  # Initialise the nodal freedom matrix to 1
61  nf = np.ones(shape=(nnd,nodof));
62
63  nf[12,0] = 0; nf[12,1] = 0;
64  nf[25,0] = 0; nf[25,1] = 0;
65  nf[38,0] = 0; nf[38,1] = 0;
66  nf[51,0] = 0; nf[51,1] = 0;
```

This is from the element type

Material and section information

This is from the element type ?

You should create the required sets here !

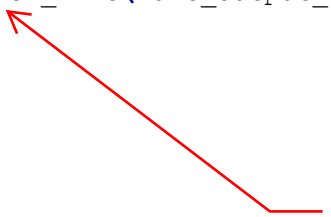
The boundary conditions section must be automated

```
nf[64,0] = 0; nf[64,1] = 0;
nf[77,0] = 0; nf[77,1] = 0;
nf[90,0] = 0; nf[90,1] = 0;

# Count the free degrees of freedom (Size of the stiffness matrix)
active_dof = 0

for i in range(0,nnd):
    for j in range(0,nodof):
        if nf[i,j] != 0:
            active_dof=active_dof+1
            nf[i,j]=active_dof

# -------
# Loading
# -------
Nodal_loads = np.zeros(shape=(nnd,nodof))
Nodal_loads[39][0]=0.0
Nodal_loads[39][1]=-1.5e+06

# Post processign info
deform_factor = 50
# ------------------------------------------------------------------------------
# Assemble the global force vector
# This force vector will have one column and active_dof-rows

force_global = np.zeros(shape=(active_dof,1))

for i in range(0,nnd):

    if nf[i][0] != 0:
        force_global[int(nf[i][0])-1] = Nodal_loads[i][0]

    if nf[i][1] != 0:
        force_global[int(nf[i][1])-1] = Nodal_loads[i][1]

# ------------------------------------------------------------------------------
# Assembly of the global stiffness matrix
# ------------------------------------------------------------------------------

# Collect the sampling points
samp = STDLIB.gaussPoints(num_gauss_points)

# Initialize the global stiffness matrix
KK = np.zeros(shape=(active_dof,active_dof))

# Form the element stiffness matrix and then assemble the global stiffness matrix
for i in range(0,nel):

    # Extract the coordinates of the element and the steering vector
    [coords,g] = STDLIB.elem_Q4(i,Nodes,Elements,nne,nodof,nf)

    # Initialize the element stiffness matrix
    ke = np.zeros(shape=(eldof,eldof))

    # Calculate the element stiffness matrix at each Gauss point
    for ig in range(0,num_gauss_points):
        for jg in range(0,num_gauss_points):

            [der_xi_eta, shapeFun] = STDLIB.fmQ4_lin(samp,ig,jg)

            # For the jacobian matrix
            jac = der_xi_eta.dot(coords)

            # Compute the inverse of the Jacobian matrix
            jac_inv = inv(jac)

```

The loading section must be automated

Get rid of that

```
134                 # Compute the derivatives of the shape functions
135                 der_x_y = jac_inv.dot(der_xi_eta)
136 
137                 # Form the B-matrix
138                 bee = STDLIB.formbee_Q4_lin(der_x_y,nne,eldof)
139 
140                 # Integrate the stiffness matrix
141                 wi = samp[ig][1]
142                 wj = samp[ig][1]
143                 d = np.linalg.det(jac)
144 
145                 ke = np.add(ke, reduce(np.dot, [d, thick, wi, wj, bee.transpose(), dee,bee]))
146 
147         # Form the global stiffness matrix
148         KK = STDLIB.form_KK(KK,ke,g,eldof)
149 
150     # Invert the global stiffness matrix and find the unknown displacements
151     delta = inv(KK).dot(force_global)
152 
153     # Seperate the displacements into its componenets
154     # ------------------------------------------------
155     node_disp = STDLIB.seprarate_disp(nodof,nnd,delta,nf)
156 
157     nodesFinal = Nodes[...,1:] + deform_factor*node_disp
158 
159 
160     # Name of the output database
161     name_output_db = name_ip_file + '.msh'
162     # POSTPRO.write_gmsh_file(name_output_db,nnd,Nodes[...,1:],node_disp,nel,Elements)
163     # POSTPRO.write_gmsh_file(name_output_db,nnd,nodesFinal,node_disp,nel,Elements)
164     POSTPRO.write_gmsh_file(name_output_db,nnd,node_disp,node_disp,nel,Elements)
165 
166 
```



The post processor doesn't know what field outputs were requested.