Department of Mechanical Engineering
University of Bath

ME40064: System Modelling & Simulation
ME50344: Engineering Systems Simulation

Tutorial 5: The Use of Numerical Integration Techniques within the Finite Element Method

Example Solutions – PART B

1. Write the `EvalBasis.m` function:

```
function [ psi ] = EvalBasis(lnid,xipt)
%EvalBasis Evaluates linear Lagrange basis functions
%   Given the local node id (lnid) for a linear Lagrange element, and
a xi
%   coordinate (between [-1,1]), returns the correpsonding value of
the
%   basis function for that local node, at that xi point

  sign = (-1)^(lnid+1)
  psi = 0.5*(1 + ((sign*xipt)))

end
```

2. Write the `EvalField.m` function:

```
function [ val ] = EvalField(msh,field,eID,xipt)
%EvalField Evaluates a nodally stored scalar field at a given xi
point in
%an element
%   Evaluates a scalar data field (stored in field) that is
represented on a linear Lagrange
%   finite element mesh (msh), when given a xi coordinate and an
element id

    psi = [EvalBasis(0,xipt) EvalBasis(1,xipt)]; %Get vector
containing basis function values at xipt
    vcoeff = [field(msh.elem(eID).n(1)); field(msh.elem(eID).n(2))];
%Get nodal values for element eID
    val = psi*vcoeff; %Dot product the two together to sum up the
coefficients*basis functions to give the final interpolated value

end
```