National Taiwan University	Finite Element Method
	Time: 90 minutes 試卷隨答案卷繳回

Total 100%

1.

$$\frac{d^2u}{dx^2} + u = 4x, 0 < x < 1$$

$$u(0) = 0, u(1) = 1$$

(a)

(b)

$$\frac{d^2u}{dx^2} + u - 4x = 0$$

$$\int w\frac{d^2u}{dx^2}dx + \int wudx - 4\int wxdx = 0$$

$$\int w\frac{d}{dx}(\frac{du}{dx})dx + \int wudx - 4\int wxdx = 0$$

$$w\frac{du}{dx}\Big|_{x=0}^{x=1} - \int_0^1 \frac{dw}{dx}(\frac{du}{dx})dx + \int_0^1 wudx - 4\int_0^1 wxdx = 0$$

Find $u(x)$ among the smooth functions that satisfy $u(0) =$, $u(1) = 1$ such that

$$\int_0^1 \frac{dw}{dx}(\frac{du}{dx})dx = \int_0^1 wudx - 4\int_0^1 wxdx = 0 \qquad \forall w \quad w(0) = 0 \ , w(1) = 0$$

2.

$$\frac{d}{dx}(EA\frac{du}{dx})+\mathrm{b(x)}=0 \qquad where \quad b(\mathrm{x})=-4\,\mathrm{x} \qquad EA=\mathrm{x}$$

$$u^{e}(\mathrm{x})=\frac{1}{x_2-x_1}\begin{bmatrix}x_2-x & x-x_1\end{bmatrix}\begin{bmatrix}u_1\\u_2\end{bmatrix}$$

$$B=\frac{1}{x_2-x_1}\begin{bmatrix}-1 & 1\end{bmatrix}$$

$$\mathbf{K}=\int_{x_1}^{x_2}\mathbf{B}^{\mathrm{T}}\mathbf{AEB}dx$$

$$=\frac{1}{(x_2-x_1)^2}\int_{x_1}^{x_2}\begin{bmatrix}-1\\1\end{bmatrix}x\begin{bmatrix}-1 & 1\end{bmatrix}dx$$

$$=\frac{x_2+x_1}{2(x_2-x_1)}\begin{bmatrix}1 & -1\\-1 & 1\end{bmatrix}$$

$$\mathbf{f}_{\Omega}^{\mathbf{e}}=\int_{x_1}^{x_2}\mathbf{N}^{\mathrm{T}}b(\mathrm{x})dx$$

$$=\int_{x_1}^{x_2}\frac{1}{x_2-x_1}\begin{bmatrix}x_2-x\\x-x_1\end{bmatrix}(-4x)dx$$

$$=\frac{2(\mathrm{x}_1-\mathrm{x}_2)}{3}\begin{bmatrix}2x_1+x_2\\x_1+2x_2\end{bmatrix}$$

3.

```
disp(size(rand(5)))
```

Command Window

New to MATLAB? See resources for Getting Started.

```
>> disp(size(rand(5)))
     5     5

fx >>
```

```
A1 = [9.9, 9900];
A2 = [8.8,  7.7 ; ...
      8800, 7700];
formatSpec = 'X is %4.2f meters or %8.3f mm\n';
fprintf(formatSpec,A1,A2)
```

Command Window

New to MATLAB? See resources for Getting Started.

```
X is 9.90 meters or 9900.000 mm
X is 8.80 meters or 8800.000 mm
X is 7.70 meters or 7700.000 mm
fx >>
```

```
A = [1 2 3 4; 5 6 7 8; 9 10 11 12; 13 14 15 16];
disp(A(:,2:3))
disp(A(:,:))
disp(A(:))
```