BSc Civil engineering 2

Index number:6934921

Assignment 3

Computer Programming

import numpy as np

L = 12 #length of beam in meters w = 10 #intensity of load in KN/m

#Question a

#Bending moment(M) and shear force(V) at the first end, x=0 x=0

M = (w\*(-6\*x\*\*2 + 6\*L\*x-L\*\*2))/12

V = w\*(L/2 - x)

m= 'The bending moment at x=0 is '

n= 'the shear force at x=0 is '

print()

print('(a.1)' + m + str(M) + ' and ', n + str(V))

#Bending moment(M) and shear force(V) at the first end, x=L=10 x=L

M = (w\*(-6\*x\*\*2 + 6\*L\*x-L\*\*2))/12

V = w\*(L/2 - x)

a= 'The bending moment at x=L is '

b= 'the shear force at x=L is '

print()

print('(a.2)' + m + str(M) +' and ', n + str(V))

#Question b

"""

When the bending moment is zero, we get an expression x\*\*2 - Lx + L\*\*2/6 = 0 """

#from the expression

a =1

b = -L

c = L\*\*2/6

#Using the Almighty formula the two roots are;

discriminant = b\*\*2 - 4\*a\*c

root\_1b = (-b + np.sqrt(discriminant))/2\*a

root\_2b = (-b - np.sqrt(discriminant))/2\*a

print()

print('(b) The points of contra-flexure are {0} and {1}'.format(root\_1b,root\_2b))

#Question c

"""

When the shear force is zero, x = L/2

"""

x = L/2

print()

print('(c) The point at which V=0 is {}'.format(x))

#Question d p=0

s = 0.01 q=L+s

x = np.arange(p,q,s)

M = (w\*(-6\*x\*\*2 + 6\*L\*x-L\*\*2))/12

print()

print('(d) Using the initialized variable,the bending moment at each step in the array is {0}'.format(M))

#Question e

V = w\*(L/2 - x)

print()

print('(e) The shear force for each step along the span is {}'.format(V))

#Question f

"""

Let the absolute value of the bending moment array be AM

Also let the minimum AM be m\_AM

"""

AM = abs(M)

m\_AM = min(AM)

"""

When the bending moment is m\_AM, we get an expression x\*\*2 - Lx + (L\*\*2/6)+(2\*m\_AM)/w = 0 """

#from the above expression

a =1

b = -L

c = (L\*\*2/6)+(2\*m\_AM)/w

#Using the Almighty formula the two roots are; discriminant = b\*\*2 - 4\*a\*c

root\_1f = (-b + np.sqrt(discriminant))/2\*a

root\_2f = (-b - np.sqrt(discriminant))/2\*a

print()

print('(f) The points along L at which the absolute values of the bending moment array is minimum are {0} and {1}'.format(root\_1f,root\_2f))

#Question g

"""

Let the relative errors be r\_e

"""

r\_e1 = ((root\_1b - root\_1f)/root\_1b\*100)

r\_e2 = ((root\_2f - root\_2b)/root\_2f\*100)

print()

print('(g) The relative errors between estimated points of contra-flexure are {0}% and {1}%'.format(r\_e1,r\_e2))

#Question h

"""

Let the maximum bending moment be max\_M and the minimum bending moment be min\_M """

#for the maximum

max\_M = max(M)

"""

When the bending moment is max\_M, we get an expression x\*\*2 - Lx + (L\*\*2/6)+(2\*max\_M)/w = 0 """

a =1

b = -L

c = (L\*\*2/6)+(2\*max\_M)/w

#Using the Almighty formula the two roots are;

discriminant = b\*\*2 - 4\*a\*c

root\_1 = (-b + np.sqrt(discriminant))/2\*a

root\_2 = (-b - np.sqrt(discriminant))/2\*a

print()

print('(h.1) The points at which the maximum bending moment occur are {0} and {1}'.format(root\_1,root\_2))

#for the minimum

min\_M = min(M)

"""

When the bending moment is min\_M, we get an expression x\*\*2 - Lx + (L\*\*2//6)+(2\*min\_M)/w = 0 """

a =1

b = -L

c = (L\*\*2//6)+(2\*min\_M)/w

#Using the Almighty formula the two roots are; discriminant = b\*\*2 - 4\*a\*c

root\_1 = (-b - np.sqrt(discriminant))/2\*a root\_2 = (-b + np.sqrt(discriminant))/2\*a print()

print('(h.2) The points at which the minimum bending moment occur are {0} and {1}'.format(root\_1,root\_2))