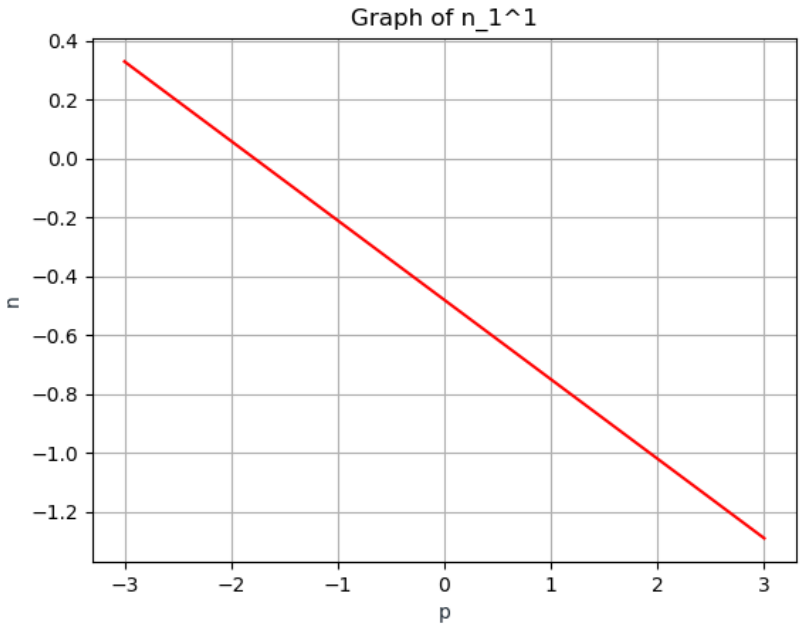
Κεφάλαιο 7

Πρόβλημα 7

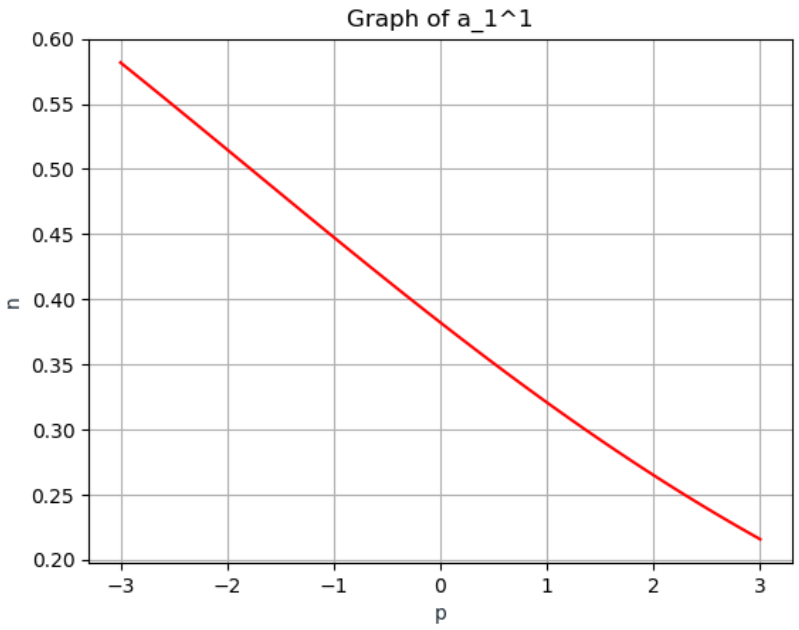
7.1 Sketching the responses

(i) $n_1^1 = \mathrm{p} \cdot \mathrm{w}_{1,1}{}^1 + b_1^1 \cdot 1 = -0.27 \cdot p - 0.48$



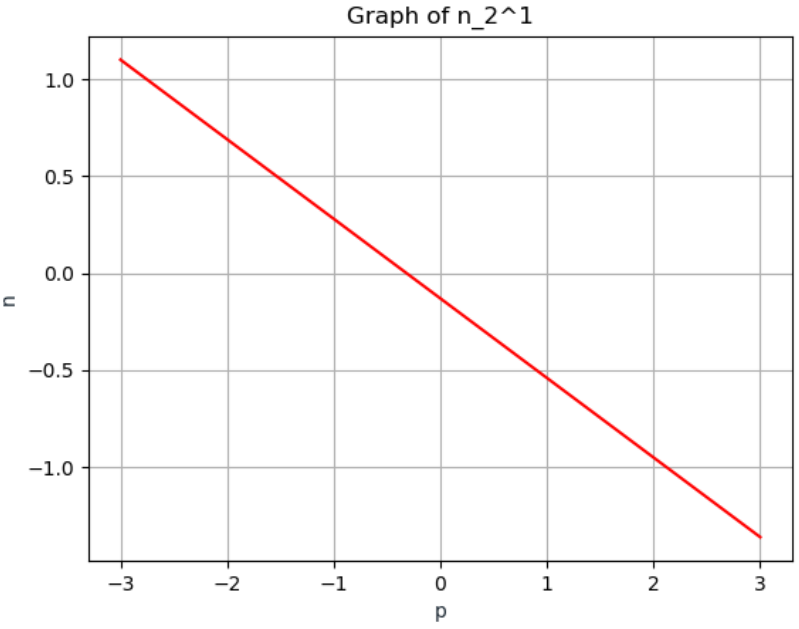
Εικόνα 7.1: *Response of* n_1^1

(ii) $a_1^1 = logsig(n_1) = \frac{1}{1+e^{-n_1}}$



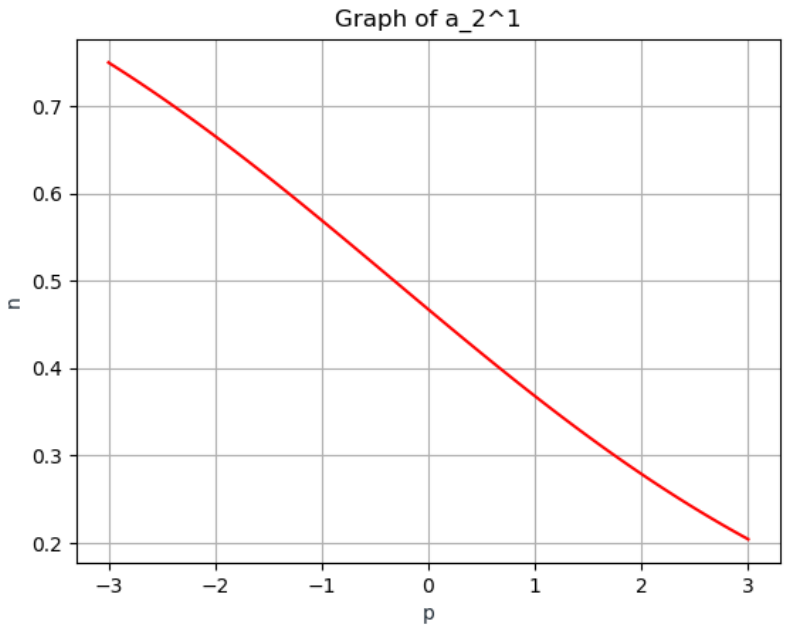
Εικόνα 7.2: *Response of* a_1^1

(iii) $n_2^1 = \mathrm{p}\cdot\mathrm{w}_{2,1}{}^1 + b_2^1 \cdot 1 = -0.41 \cdot p - 0.13$



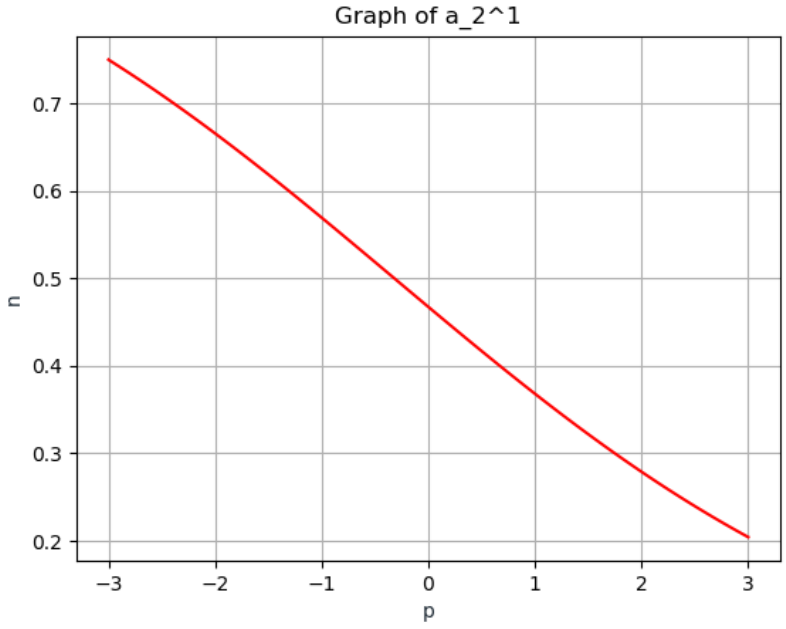
Εικόνα 7.3: *Response of* n_2^1

(iv) $a_2^1 = logsig(n_2) = \frac{1}{1+e^{-n_2}}$



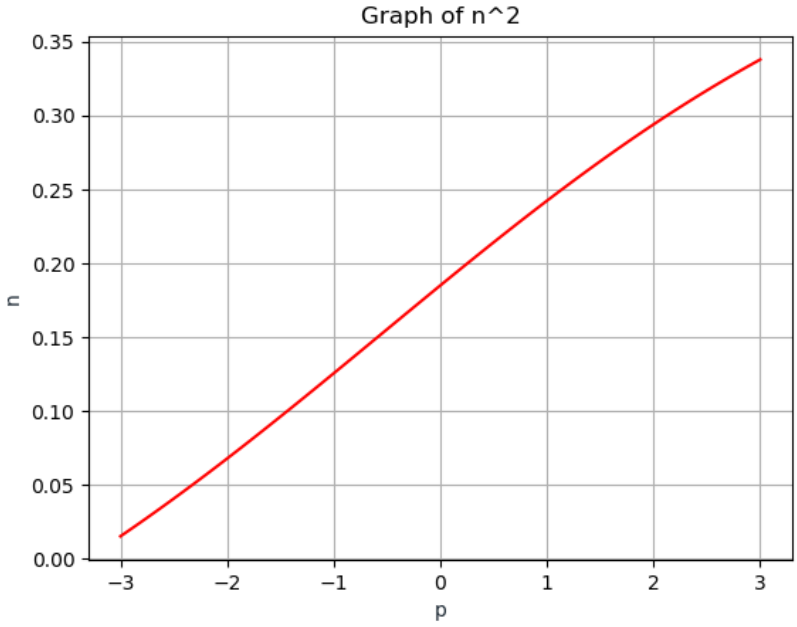
Εικόνα 7.4: *Response of* a_1^1

(v) $n^2 = a_1^1 \cdot w_{1,1}{}^2 + a_2^1 \cdot w_{1,2}{}^2 + 1 \cdot b^2 = -0.27a_1^1 - 0.41a_2^1 + 0.48$



Εικόνα 7.5: *Response of* n^2

(vi) $a^2 = purelin(n^2)^2 = n^2$



Εικόνα 7.6: *Response of* a^2

7.2 Python Code

```
# CE418: Neuro-fuzzy Computing
#
#    Evangelos Stamos
#    02338
#    estamos@e-ce.uth.gr

# Problem-07
#
#
# defines libraries and the values of the parameters
#

import numpy as np
import matplotlib.pyplot as plt

def sigmoid(x):
  return 1 / (1 + np.exp(-x))

def purelin(x):
  return x**0.5
```

```
21
22 def plott(k) :
23     plt.plot(p, k, '-r')
24     plt.xlabel('p', color='#1C2833')
25     plt.ylabel('n', color='#1C2833')
26     plt.grid()
27     plt.show()
28
29 weights = [- 0.27, - 0.41, 0.09, - 0,17]
30
31 bias = [- 0.48, - 0.13, 0.48]
32
33 p = np.linspace(-3, 3, 100) # plot indicated variable versus p for -3 <
       p < 3
34
35 # i.
36 n_1 = p*weights[0] + bias[0]
37 # ii.
38 a_1 = sigmoid(n_1)
39 # iii.
40 n_2 = p*weights[1] + bias[1]
41 # iv.
42 a_2 = sigmoid(n_2)
43 # v.
44 n_n = a_1*weights[0] + a_2*weights[1]  + bias[2]
45 # vi.
46 a_a = purelin(n_n)
47
48 # plot i.
49 plt.title('Graph of n_1^1')
50 plott(n_1)
51 # plot ii.
52 plt.title('Graph of a_1^1')
53 plott(a_1)
54 # plot iii.
55 plt.title('Graph of n_2^1')
56 plott(n_2)
57 # plot iv.
58 plt.title('Graph of a_2^1')
59 plott(a_2)
60 # plot v.
61 plt.title('Graph of n^2')
62 plott(n_n)
```

```
63 # plot vi.
64 plt.title('Graph of a^2')
65 plott(a_a)
```