Homework 1

|  |  |  |  |
| --- | --- | --- | --- |
| Person 1 | Yy | yn | Ny |
| Person 2 | yy | yn | Ny |
| Person 3 | yy | yn | ny |

|  |  |  |  |
| --- | --- | --- | --- |
| Person 4 | Yy | yn | Ny |
| Person 5 | yy | yn | Ny |
| Person 6 | yy | yn | ny |

P(0) = 1/8

P(1) = 3/8

P(2) = 3/8

P(3) = 1/8

a)

= (58/103)(1/8) + (59/103)(3/8) + (60/103)(3/8) + (61/103)(1/8)

= 0.578

b)

= (56/103)(1/8) + (57/103)(3/8) + (58/103)(3/8) + (59/103)(1/8)

= 0.558

C)

= (58/103)(1/8) + (59/103)(3/8) + (60/103)(3/8) + (61/103)(1/8)

= 0.578

D)

L {58, 59, 60, 61}

W {57, 58, 59, 60}

P(London and Wales) = P(1L, 2W) + P(0L, 1W) + P(2L, 3W)

P(London and Wales) = (59/103)(3/8)(59/103)(3/8) + (58/103)(1/8)(58/103)(3/8) +

(60/103)(3/8) (60/103)(1/8)

P(London and Wales) = 0.7691

L {58, 59, 60, 61}

I {56, 57, 58, 59}

P(London and Ireland) = P(0L, 2I) + P(1L, 3I)

P(London and Ireland) = (58/103)(1/8)(58/103)(3/8) + (59/103)(1/8)(59/103)(1/8)

P(London and Ireland) = 0.01999

S {58, 59, 60, 61}

I {56, 57, 58, 59}

P(Scotland and Ireland) = P(0S, 2I) + P(1S, 3I)

P(Scotland and Ireland) = (58/103)(1/8)(58/103)(3/8) + (59/103)(3/8)(59/103)(1/8)

P(Scotland and Ireland) = 0.03024

S {58, 59, 60, 61}

W {57, 58, 59, 60}

P(Scotland and Wales) = P(0S, 1W) + P(1S, 2W) + P(2S, 3W)

P(Scotland and Wales) = (58/103)(1/8)(58/103)(3/8) + (59/103)(3/8)(59/103)(3/8) +

(60/103)(3/8)(60/103)(1/8)

P(Scotland and Wales) = 0.07691

1. P(x=0,y=0) = ¼

P(x=1,y=0) = 0

P(x=0,y=1) = ½

P(x=1,y=1) = ¼

P(x=0) = ¾

P(x=1) = ¼

P(y=0) = ¼

P(y=1) = 3/4



H(x) = - ((3/4)log(3/4) + (1/4)log(1/4))

H(x) = 0.81128

H(y) = - ((1/4)log(1/4) + (3/4)log(3/4))

H(y) = 0.81128



H(x|y) = -((1/4)log(1) + (1/2)log(2/3) + (1/4)log(1/3))

H(x|y) = 0.68872

H(x|y) = -((1/4)log(1/3) + (1/2)log(2/3) + (1/4)log(1))

H(x|y) = 0.68872



I(x;y) = H(y) – H(y|x)

I(x;y) = 0.81128 – 0.68872

I(x;y) = 0.12256



H(x,y) = -((1/4)log(1/4) + (1/2)log(1/2) + (1/4)log(1/4))

H(x,y) = 1.5

1. Show H(y|x) = H(y), x and y independent
2. Show H(x,y) = H(x) + H(y), x and y independent

) H(y|x) = H(y)

1. Show I(x;x) = H(x)
2. Show H(x,y) – H(x) = H(y|x)

1. C)

1) False, binary decision trees can represent any linearly seperable equations of Boolean expressions not every continuous function

2) True, a neural network with 1 hidden layer can model all continuous functions, and one with > 1 hidden layers can model any arbitrary functions (more hidden layers leads to faster better solutions) so this neural network with 4 hidden layers can model any continuous function.