TIINCO 1st Hand in Assignment

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A description of the functions used can be found in the Appendix

1.3

Calculate the source entropy, the transinformation I (X, Y) and the capacity of the BSC defined in Figure P.1.1.

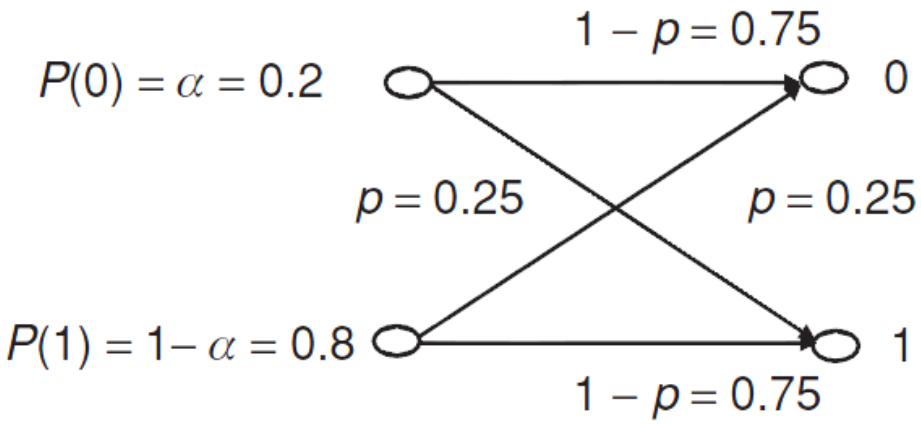

Figure P.1.1 A binary symmetric channel

```
p = 0.25;
alpha = 0.2;
```

Source entropy H(X)

```
H_X = omega(alpha)
```

```
H_X =

    0.7219
```

Average mutual information (transinformation) I(X,Y)

```
I_XY = omega(alpha + p -2*alpha*p) - omega(p)
```

```
I_XY =

    0.1228
```

Channel capacity C

```
C = 1 - omega(p)
```

```
C =

    0.1887
```

1.6

What is the capacity of the cascade of BSCs as given in Figure P.1.2?

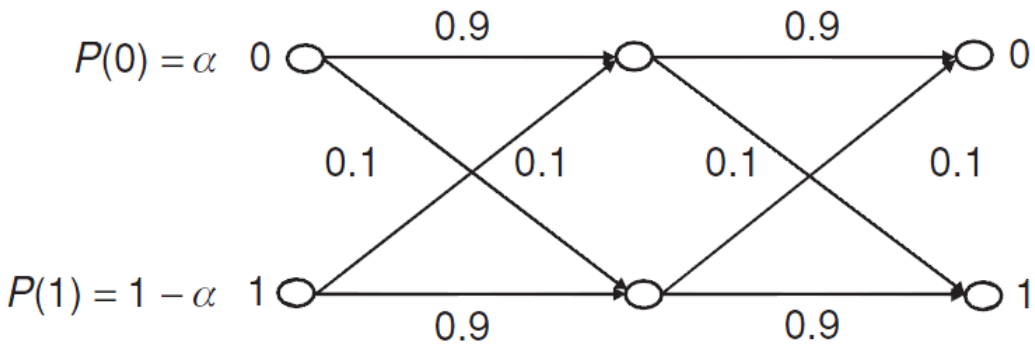

Figure P.1.2 A cascade of BSCs

```
p_cascade = 2 * (0.1 * 0.9)
C_cascade = 1 - omega(p_cascade)
```

```
p_cascade =

    0.1800
```

```
C_cascade =

    0.3199
```

1.8

Find the conditional probabilities P(xi/yj) of the BEC with an erasure probability of 0.469, when the source probabilities are 0.25 and 0.75. Hence find the equivocation, transinformation and capacity of the channel.

```
p = 0.469;
alpha = 0.25;
P_X0 = 0.25;
P_X1 = 0.75;
```

Output probabilities

```
P_Y0 = P_X0 * (1 - p);

P_Yerror = p;

P_Y1 = P_X1 * (1 - p);
```

Conditional probabilities (backward) P(xi/yj)

```
P_X0Y0 = ((1 - p) * P_X0)/P_Y0

P_X0Yerror = (p * P_X0)/P_Yerror

P_X1Yerror = (p * P_X1)/P_Yerror

P_X1Y1 = ((1 - p) * P_X1)/P_Y1
```

```
P_X0Y0 =

     1


P_X0Yerror =

    0.2500


P_X1Yerror =

    0.7500


P_X1Y1 =

     1
```

Transinformation

```
I_XY = (1-p) * omega(alpha)
```

```
I_XY =
```

```
    0.4308
```

Equivocation H(X/Y)

```
% Source entropy
H_X = P_X0 * log2(1/P_X0) + P_X1 * log2(1/P_X1);

H_XY = H_X - I_XY
```

```
H_XY =

    0.3805
```

Capacity

```
C = 1 - p
```

```
C =

    0.5310
```

Appendix

```
function o = omega(x)

o = x * log2(1/x) + (1-x) * log2(1/(1-x));
```

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