Example of DRC written text for DCR 6 credits (a.y. 23-24 first semester)

A) In an image database in a children school is used to teach a foreign language. Every word is associated to an image representing objects, places or concept. The images are clustered according the following criteria:

Animals: 200 images

Botanic images (plants, flowers, trees…) 200 images

Objects of indoor life: 300 images

Cars, trains and vehicles: 500 images

Colors, geometrical shapes and solids: 100 images

A query is performed on the database, using the query-by example paradigm. The image submitted in the query is the following photo

Caption of the photo: Rose

The system returns 10 images, whose semantic content is the following:

2 tigers, 1 pine, 2 tulips, 1 book, 2 tables, 1 bicycle, 1 pyramid.

Compute the Precision and the Recall of the query.

Using the query by example paradigm, the example image belongs to the class "botanic images", which is therefore the "relevant class". In the returned images, only three images are of the same class (1 pine, 2 tulips) Therefore the computation is:

Precision: number of returned relevant images / total number of returned images: 3/10 = 0.3

Recall = number of returned relevant images / cardinality of the class of the relevant image = 3/200 = 0.015:

Additional question. Suppose to perform another query using the paradigm of searching by metadata, using as metadata the word of the captions of the images. The user submits the query by specifying the word:

Rose

The result is the same of the previous case. What about Precision and Recall?

Using the textual metadata there is a semantic ambiguity because the term "rose" may refer both to the class "Botanic images" and to "Colors, geometrical shapes and solids" (Rose is both a flower and a color). Therefore, it is not possible to determine which is the relevant class (the second or the last one?). For this reason, it is not possible to compute Precision and Recall.

B) Draw the reduction tree for the Huffman code for an alphabet of 4 symbols a1, a2, a3, and a4, with the following probability p(aj) (for j=1,2…4) of occurring in the coded string:

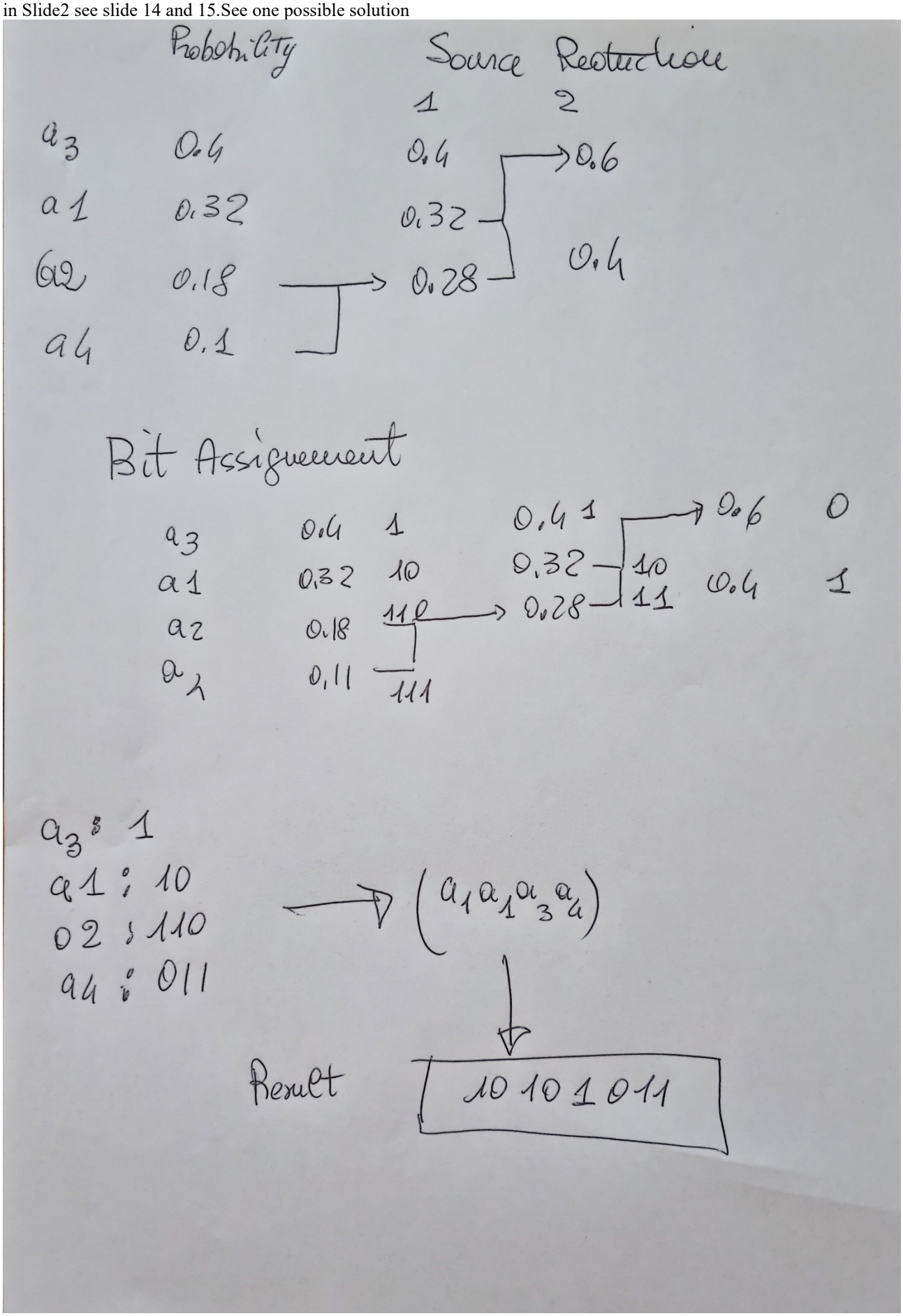
P(a1) = 0.32; P(a2) = 0.18; P(a3) = 0.4; P(a4) = 0.1

Code the following string a1 a1 a3 a4

See Lesson #3,4,5 and related sources on

http://csu.unipv.it/lucidimoda-copy/

in Slide2 see slide 14 and 15.See one possible solution



+1 points for a right answer, -1 for a wrong answer, 0 for no answer (one or more choices are possible):

1) JPEG2000 has the following features:
- It is not sensible to block distortion
- Its performance in terms of quality of compressed lossy image are better than JPEG (at a fixed compression rate)
- Its performance in terms of quality of compressed lossless image are lower than JPEG (at a fixed compression rate)
- Its performance in terms of achievable bit rate of compressed lossy image are better than JPEG (at a fixed image quality)

2) List at least three types of images referring to the electromagnetic spectrum band to which they belong to:
See

3) In the arithmetic coding the length of the coded string:
- Depends on the probabilities of the symbols
- Depends on the lengths of the coded string
- It is fixed
- None of the previous ones

4) The SSIM metric for quality evaluation of digital images takes into consideration the following information in the images:
- Colour
- Luminance
- Header metadata
- Edges and regions

5) In the watermarking approach for securing image databases
- The watermark is always an image
- The watermark is always generated in run time during the query
- The watermark is always derived from some part of the information carried out by the image
- The watermark depends on the entropy of the image
- None of the previous

6) Relevance feedback is used
- To increase the precision of the query
- To increase the recall of the query
- To increase the speed of the query
- None of the previous ones

7) In the problem of authentication in a biometric database, making the query means
- A many-to-one mapping of information
- A one-to-one mapping of information
- A many to many mapping of information