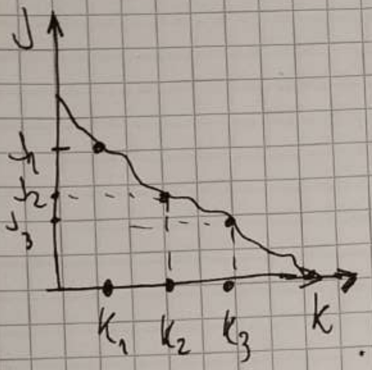
VI9

1.1 a)




Minimalna vrijednost fje J = 0.
i to za K = broj primjera.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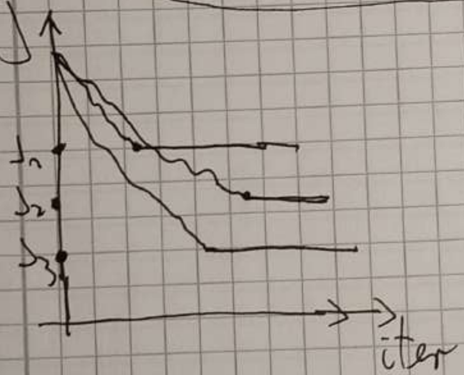
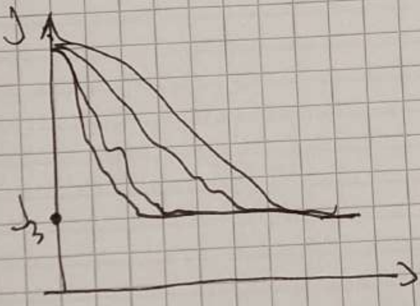
b)

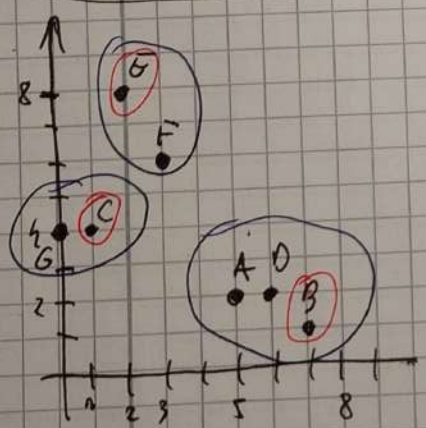



c) Uzmimo $K_3$




Za k++ najizglednija krivulja je ona koja PRVA dođe do J3. Zato jer k++ već počinje iteracije s "dobrim" centroidima.

1.2.




a, b) Oba algoritma u 1. koraku rade grupiranja kao na slici. k-means zatim u svakoj grupi računa novi centroid. A to su:

$$\vec{\mu}_k = \left[ \frac{1}{2}\left( (2,8)+(3,6) \right), \frac{1}{2}\left( (0,4)+(1,4) \right), \frac{1}{3}\left( (5,2)+(6,2)+(7,1) \right) \right]$$

k-medoids gleda koji primjer od trenutnih medoida minimizira grešku u svakoj grupi. Novi mogući medoidi su:

E ili F, C ili G, D

nejasno, ista greška

1.2.

c) k-medians: $O(Tn Nk)$ N - broj primjera

k-medoids: $O(Tk(N-k)^2)$ k - broj grupa

m - broj značajki

d) Prednost je što može raditi na podatcima koji nisu iz vektorskog prostora. Nedostatak je taj što nema efikasne implementacije pa je složenost velika

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V20

1.1

a) EM-algoritam koristi meko grupiranje gdje imamo probabilistički izlaz. U odnosu na k-means složeniji je.

b)

$$p(x) = \sum_k^K p(x, y=k) = \sum_k^K \pi_k \, p(x|\theta_k)$$

$$\ln L(\theta|D) = \sum_i \ln \sum_k \pi_k \, p(x^{(i)}|\theta_k)$$

c) $$p(x, z|\theta) = \prod_k^K \pi_k^{z_k} \, p(x|\theta_k)^{z_k}$$

$$\ln L(\theta|D, z) = \sum_i \sum_k z_k^i (\ln \pi_k + \ln p(x^{(i)}|\theta_k))$$

Ne možemo jer su $z^{(i)}$ varijable nisu poznate.

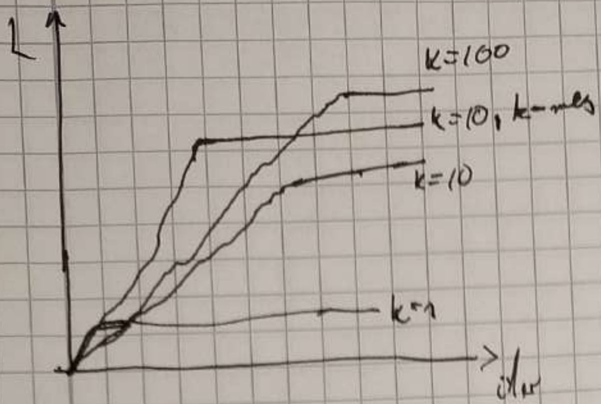
d)

E-korak: $\forall x^i, \forall k$ $$h_k^{(i)} = \frac{p(x^{(i)}|\mu_k, \Sigma_k)\pi_k}{\sum_j p(x^{(i)}|\mu_j, \Sigma_j)\pi_j}$$

M-korak: $\forall k$

$$\mu_k = \frac{\sum_i h_k^i x^i}{\sum_i h_k^i}, \quad \Sigma_k = \frac{\sum_i h_k^i (x^i-\mu_k)(x^i-\mu_k)^T}{\sum_i h_k^i}, \quad \pi_k = \frac{1}{N}\sum_i h_k^i$$

1.1. b)

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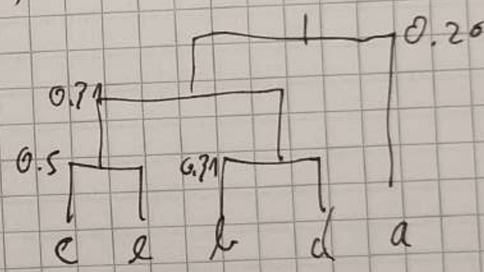
2.2

a) MAX, MAX

$$S = \begin{array}{c} \\ \\ \\ \\ \\ \end{array}\begin{array}{ccccc} a & b & c & d & e \end{array}$$
$$\left(\begin{array}{ccccc} 1 & 0.26 & 0.15 & 0.2 & 0.17 \\ & 1 & 0.24 & 0.31 & 0.31 \\ & & 1 & 0.2 & 0.5 \\ & & & 1 & 0.24 \\ & & & & 1 \end{array}\right) \rightarrow \begin{array}{c|cccc} & a & b & d & ce \\ \hline a & 1 & 0.26 & 0.2 & 0.17 \\ b & & 1 & 0.31 & 0.31 \\ d & & & 1 & 0.24 \\ ce & & & & 1 \end{array}$$

$$\rightarrow \begin{array}{c|ccc} a & 1 & 0.26 & 0.17 \\ bd & & 1 & 0.31 \\ ce & & & 1 \end{array} \rightarrow \begin{array}{c|cc} a & 1 & 0.26 \\ bdce & & 1 \end{array}$$

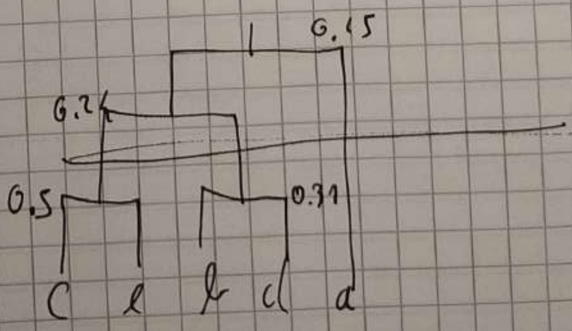



Na razini gdje bi bilo {{c,e},{b,d},{a}}

b) MIN

$$\rightarrow \begin{array}{c|cccc} & a & b & d & ce \\ \hline a & 1 & 0.26 & 0.2 & 0.15 \\ b & & 1 & 0.31 & 0.24 \\ d & & & 1 & 0.24 \\ ce & & & & 1 \end{array} \rightarrow \begin{array}{c|ccc} a & 1 & 0.2 & 0.15 \\ bd & & 1 & 0.24 \\ ce & & & 1 \end{array}$$

$$\rightarrow \begin{array}{c|cc} a & 1 & 0.15 \\ bdce & & 1 \end{array}$$




Ovdje presjeći

V21.

1.1

pred

| | 0 | 1 | 2 |
|---|---|---|---|
| 0 | 1 | 0 | 1 |
| 1 | 1 | 3 | 2 |
| 2 | 1 | 1 | 1 |

2:

| | 2 | 01 |
|---|---|---|
| 2 | 1 | 2 |
| 01 | 3 | 5 |

0:

| | 0 | 12 |
|---|---|---|
| 0 | 1 | 1 |
| 12 | 2 | 7 |

1:

| | 1 | 02 |
|---|---|---|
| 1 | 3 | 3 |
| 02 | 1 | 4 |

a) Točnost = $\Sigma$ po dijagonali $/N = \underline{5/11} = Acc$

b)

$$P^M = \frac{1}{3}\left(\frac{1}{2} + \frac{3}{6} + \frac{1}{3}\right) = 0.444$$

$$R^M = \frac{1}{3}\left(\frac{1}{3} + \frac{3}{4} + \frac{1}{4}\right) = 0.444$$

$$F_1^M = \frac{1}{3}\left(\frac{2\cdot\frac{1}{2}\cdot\frac{1}{3}}{\frac{1}{2}+\frac{1}{3}} + \frac{2\cdot\frac{3}{6}\cdot\frac{3}{4}}{\frac{3}{6}+\frac{3}{4}} + \frac{2\cdot\frac{1}{3}\cdot\frac{1}{4}}{\frac{1}{3}+\frac{1}{4}}\right) = \frac{1}{3}(0.4+0.6+0.285) = 0.428$$

MIKRO TABLICA ($\Sigma_k$ tablica)

$$= \begin{pmatrix} 5 & 6 \\ 6 & 16 \end{pmatrix}$$

$$P^\mu = \frac{5}{11} \qquad R^\mu = \frac{5}{11}$$

$$F_1^\mu = \frac{2\cdot P\cdot R}{P+R} = \frac{5}{11}$$

$$Acc = F_1^\mu = P^\mu = R^\mu$$

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