

RISHYA . P . MURTHY
8M 875

CS636 - FINALS.

DATA ANALYTICS WITH R.

problem ①

- (a) 1) msleep [, grep ("de", colnames (msleep))]
- 2) subset (msleep, sleep-total > 10 & !is.na (sleep-cycle))
- 3) msleep [order (msleep\$sleep-total, decreasing = T),]

(b) 4)

variable value?

1. vs 0

2. vs 1

3. R9T vs IN OUT 97 97

4. 4580 vs E 0 4 9 1 9 9 8

5. 5280 vs S 0 4 0 5 9 8 0

6. 6510 vs I 1 1 0 5 9 1 0

7. 7.0 am 1 1 5 1 5 1 0

8. 8.0 am 1 1 5 5 5 1 0

9. 9.0 am 1 1 5 5 5 1 0

10. 10.0 am 1 1 0 4 5 1 0

11. 11.0 am 0 1 0 4 4 9 1 0

12. am 1

5) 21.0 > vs = am.

2/6 = 6/6 (1)

Problem ③

counter = 3.

Problem 4

$$(1) \text{ (a)} \quad \text{Precision} = \frac{\frac{TP}{\text{pred}}}{TP + FP}, \quad \text{Recall} = \frac{\frac{TP}{\text{pred}}}{TP + FN}$$

		pred			
act	Y	TP	FN		
	N	FP	TN		
				3	1
				N	1 3

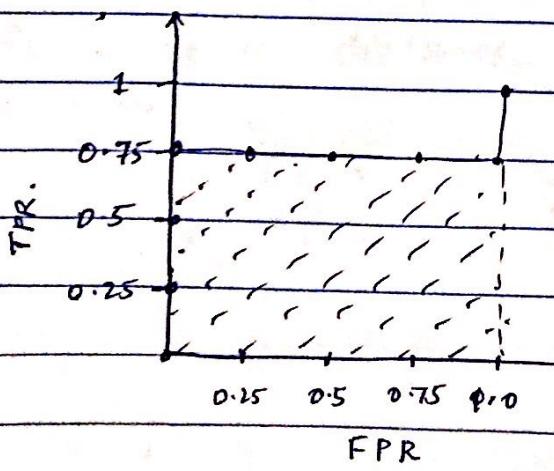
\Rightarrow act Y 3 1 N 1 3

$$\therefore \text{Precision} = \frac{3}{(3+1)} = 0.75$$

$$\text{Recall} = \frac{3}{(3+1)} = 0.75.$$

(b)

		TP	FP	TN	FN	TPR	FPR
0.9	P	1	0	4	3	$\frac{1}{4} = 0.25$	0
0.8	P	2	0	4	2	$\frac{2}{4} = 0.5$	0
0.7	P	3	0	4	1	$\frac{3}{4} = 0.75$	0
0.6	N	3	1	3	1	$\frac{3}{4} = 0.75$	$\frac{1}{4} = 0.25$
0.5	N	3	2	2	1	$\frac{3}{4} = 0.75$	$\frac{2}{4} = 0.5$
0.4	N	3	3	1	1	$\frac{3}{4} = 0.75$	$\frac{3}{4} = 0.75$
0.2	N	3	4	0	1	$\frac{3}{4} = 0.75$	$\frac{4}{4} = 1$
0.1	P	4	4	0	0	$\frac{4}{4} = 1$	$\frac{4}{4} = 1$



Area of under the curve:

$$= \sqrt{1} \times 0.75$$

< 0.75 sq units.

(2) R function for AUC

~~my.auc <- function(TPR, FPR){~~

~~# input sorted, test scores first~~

~~dFPR <- c(diff(FPR), 0)~~

~~dTPR <- c(diff(TPR), 0)~~

~~sum(TPR * dFPR) + sum(dTPR + dFPR) / 2~~

~~}~~

Problem (5) $G_1 = (2, 2, 4, 5)$, $C_1 = (0, 0, 0, 0)$

$G_2 = (2, 2, 2, 2)$, $C_2 = (10, 10, 10, 10)$

$G_3 = (2, 2, 0, 2)$ Initial centroids.

$G_4 = (10, 8, 10, 6)$

$G_5 = (12, 10, 10, 8)$

Calculating the distance of each gene from the both centroids:

$$G_1 - C_1 = \sqrt{(2-0)^2 + (2-0)^2 + (4-0)^2 + (5-0)^2} = 7$$

$$G_1 - C_2 = \sqrt{(10-2)^2 + (10-2)^2 + (10-4)^2 + (10-5)^2} = 13.74$$

$$G_2 - C_1 = \sqrt{(2-0)^2 + (2-0)^2 + (2-0)^2 + (2-0)^2} = 4$$

$$G_2 - C_2 = \sqrt{(10-2)^2 + (10-2)^2 + (10-2)^2 + (10-2)^2} = 16$$

$$G_3 - C_1 = \sqrt{(2-0)^2 + (2-0)^2 + (0-0)^2 + (2-0)^2} = 3.46$$

$$G_3 - C_2 = \sqrt{(10-2)^2 + (10-2)^2 + (10-0)^2 + (10-2)^2} = 17.08.$$

$$G_4 - C_1 = \sqrt{(10-0)^2 + (8-0)^2 + (10-0)^2 + (6-0)^2} = 17.32.$$

$$G_4 - C_2 = \sqrt{(10-10)^2 + (10-8)^2 + (10-10)^2 + (10-6)^2} = 6.32$$

$$G_5 - C_1 = \sqrt{(12-0)^2 + (10-0)^2 + (10-0)^2 + (8-0)^2} = 20.2$$

$$G_5 - C_2 = \sqrt{(10-12)^2 + (10-10)^2 + (10-10)^2 + (10-8)^2} = 2.83.$$

From the above calculations, we form clusters based on the genes' distance to each ~~cluster~~ centroid

\therefore Cluster 1, closer to centroid $C_1 = \{G_1, G_2, G_3\}$

Cluster 2, closer to centroid $C_2 = \{G_4, G_5\}$

New centroids will be:

$$\text{Considering } \{G_1, G_2, G_3\} \Rightarrow \left(\frac{2+2+2}{3}, \frac{2+2+2}{3}, \frac{4+2}{3}, \frac{5+2+2}{3} \right)$$

$$\rightarrow C_1 = (2, 2, 2, 3)$$

$$\text{Considering } \{G_4, G_5\} \Rightarrow \left(\frac{10+12}{2}, \frac{8+10}{2}, \frac{10+10}{2}, \frac{6+8}{2} \right)$$

$$\rightarrow C_2 = (11, 9, 10, 7)$$

Above are the new centroids & their affiliated genes.

Problem ⑥

a) Cluster distance b/w $\{1, 5\}$ and $\{2, 3, 4\}$

$$(i) \text{ MIN} = 1$$

$$(ii) \text{ MAX} = 8$$

$$(iii) \text{ GROUP AVERAGE} = 4.33$$

b) Step 1:

First cluster formed : $\{1, 3\}$

$\{1, 3\}$	2	4	5	Filling the matrix		
$\{1, 3\}$	0					
2	8	0				
4	7	6	0			
5	9	3	2	0		

Step 2:

Next cluster formed = $\{4, 5\}$

$\{1, 3\}$ 2 $\{4, 5\}$

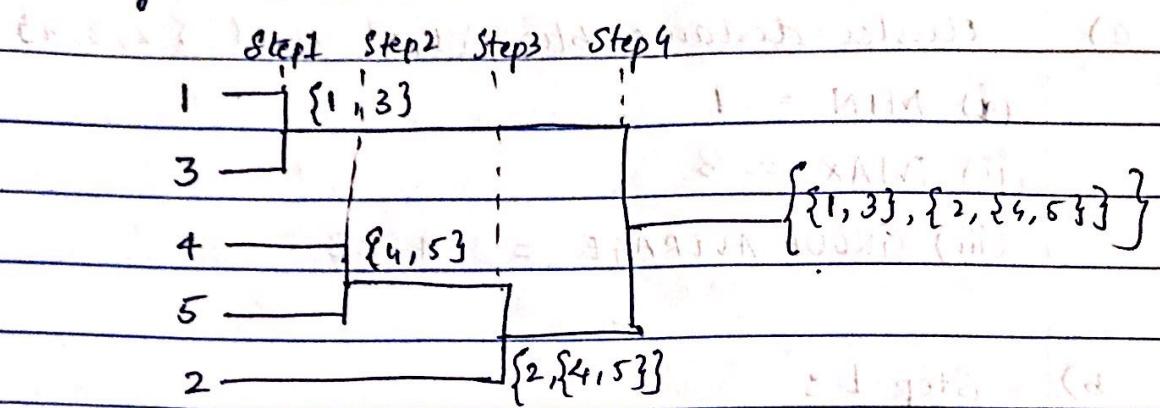
$\{1, 3\}$	0					
2	8	0	1	0	1	
$\{4, 5\}$	9	1	6	0	0	

Step 3:

Next cluster : $\{2, \{4, 5\}\}$

$\{1, 3\}$	$\{2, \{4, 5\}\}$				
$\{1, 3\}$	0				
$\{2, \{4, 5\}\}$	9	11	0		

Dendrogram:



Problem # a) First quartile = 2 & 18.13

Second quartile = 4 & 18.13

$$\text{IQR} = 2.$$

b) 1) $a = 10, 3, 0, 8, 5, 2$

$$\dim(a) = 1 \quad 2$$

2) $0, 3, 6, 10, 13, 16, 18, 21, 24, 27, 30, 33, 36, 39, 42, 45, 48, 51, 54, 57, 60, 63, 66, 69, 72, 75, 78, 81, 84, 87, 90, 93, 96, 99, 102, 105, 108, 111, 114, 117, 120, 123, 126, 129, 132, 135, 138, 141, 144, 147, 150, 153, 156, 159, 162, 165, 168, 171, 174, 177, 180, 183, 186, 189, 192, 195, 198, 201, 204, 207, 210, 213, 216, 219, 222, 225, 228, 231, 234, 237, 240, 243, 246, 249, 252, 255, 258, 261, 264, 267, 270, 273, 276, 279, 282, 285, 288, 291, 294, 297, 298, 300, 302, 304, 306, 308, 310, 312, 314, 316, 318, 320, 322, 324, 326, 328, 330, 332, 334, 336, 338, 340, 342, 344, 346, 348, 350, 352, 354, 356, 358, 360, 362, 364, 366, 368, 370, 372, 374, 376, 378, 380, 382, 384, 386, 388, 390, 392, 394, 396, 398, 400, 402, 404, 406, 408, 410, 412, 414, 416, 418, 420, 422, 424, 426, 428, 430, 432, 434, 436, 438, 440, 442, 444, 446, 448, 450, 452, 454, 456, 458, 460, 462, 464, 466, 468, 470, 472, 474, 476, 478, 480, 482, 484, 486, 488, 490, 492, 494, 496, 498, 500, 502, 504, 506, 508, 510, 512, 514, 516, 518, 520, 522, 524, 526, 528, 530, 532, 534, 536, 538, 540, 542, 544, 546, 548, 550, 552, 554, 556, 558, 560, 562, 564, 566, 568, 570, 572, 574, 576, 578, 580, 582, 584, 586, 588, 590, 592, 594, 596, 598, 600, 602, 604, 606, 608, 610, 612, 614, 616, 618, 620, 622, 624, 626, 628, 630, 632, 634, 636, 638, 640, 642, 644, 646, 648, 650, 652, 654, 656, 658, 660, 662, 664, 666, 668, 670, 672, 674, 676, 678, 680, 682, 684, 686, 688, 690, 692, 694, 696, 698, 700, 702, 704, 706, 708, 710, 712, 714, 716, 718, 720, 722, 724, 726, 728, 730, 732, 734, 736, 738, 740, 742, 744, 746, 748, 750, 752, 754, 756, 758, 760, 762, 764, 766, 768, 770, 772, 774, 776, 778, 780, 782, 784, 786, 788, 790, 792, 794, 796, 798, 800, 802, 804, 806, 808, 810, 812, 814, 816, 818, 820, 822, 824, 826, 828, 830, 832, 834, 836, 838, 840, 842, 844, 846, 848, 850, 852, 854, 856, 858, 860, 862, 864, 866, 868, 870, 872, 874, 876, 878, 880, 882, 884, 886, 888, 890, 892, 894, 896, 898, 900, 902, 904, 906, 908, 910, 912, 914, 916, 918, 920, 922, 924, 926, 928, 930, 932, 934, 936, 938, 940, 942, 944, 946, 948, 950, 952, 954, 956, 958, 960, 962, 964, 966, 968, 970, 972, 974, 976, 978, 980, 982, 984, 986, 988, 990, 992, 994, 996, 998, 1000, 1002, 1004, 1006, 1008, 1010, 1012, 1014, 1016, 1018, 1020, 1022, 1024, 1026, 1028, 1030, 1032, 1034, 1036, 1038, 1040, 1042, 1044, 1046, 1048, 1050, 1052, 1054, 1056, 1058, 1060, 1062, 1064, 1066, 1068, 1070, 1072, 1074, 1076, 1078, 1080, 1082, 1084, 1086, 1088, 1090, 1092, 1094, 1096, 1098, 1100, 1102, 1104, 1106, 1108, 1110, 1112, 1114, 1116, 1118, 1120, 1122, 1124, 1126, 1128, 1130, 1132, 1134, 1136, 1138, 1140, 1142, 1144, 1146, 1148, 1150, 1152, 1154, 1156, 1158, 1160, 1162, 1164, 1166, 1168, 1170, 1172, 1174, 1176, 1178, 1180, 1182, 1184, 1186, 1188, 1190, 1192, 1194, 1196, 1198, 1200, 1202, 1204, 1206, 1208, 1210, 1212, 1214, 1216, 1218, 1220, 1222, 1224, 1226, 1228, 1230, 1232, 1234, 1236, 1238, 1240, 1242, 1244, 1246, 1248, 1250, 1252, 1254, 1256, 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2586, 2588, 2590, 2592, 2594, 2596, 2598, 2600, 2602, 2604, 2606, 2608, 2610, 2612, 2614, 2616, 2618, 2620, 2622, 2624, 2626, 2628, 2630, 2632, 2634, 2636, 2638, 2640, 2642, 2644, 2646, 2648, 2650, 2652, 2654, 2656, 2658, 2660, 2662, 2664, 2666, 2668, 2670, 2672, 2674, 2676, 2678, 2680, 2682, 2684, 2686, 2688, 2690, 2692, 2694, 2696, 2698, 2700, 2702, 2704, 2706, 2708, 2710, 2712, 2714, 2716, 2718, 2720, 2722, 2724, 2726, 2728, 2730, 2732, 2734, 2736, 2738, 2740, 2742, 2744, 2746, 2748, 2750, 2752, 2754, 2756, 2758, 2760, 2762, 2764, 2766, 2768, 2770, 2772, 2774, 2776, 2778, 2780, 2782, 2784, 2786, 2788, 2790, 2792, 2794, 2796, 2798, 2800, 2802, 2804, 2806, 2808, 2810, 2812, 2814, 2816, 2818, 2820, 2822, 2824, 2826, 2828, 2830, 2832, 2834, 2836, 2838, 2840, 2842, 2844, 2846, 2848, 2850, 2852, 2854, 2856, 2858, 2860, 2862, 2864, 2866, 2868, 2870, 2872, 2874, 2876, 2878, 2880, 2882, 2884, 2886, 2888, 2890, 2892, 2894, 2896, 2898, 2900, 2902, 2904, 2906, 2908, 2910, 2912, 2914, 2916, 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3582, 3584, 3586, 3588, 3590, 3592, 3594, 3596, 3598, 3600, 3602, 3604, 3606, 3608, 3610, 3612, 3614, 3616, 3618, 3620, 3622, 3624, 3626, 3628, 3630, 3632, 3634, 3636, 3638, 3640, 3642, 3644, 3646, 3648, 3650, 3652, 3654, 3656, 3658, 3660, 3662, 3664, 3666, 3668, 3670, 3672, 3674, 3676, 3678, 3680, 3682, 3684, 3686, 3688, 3690, 3692, 3694, 3696, 3698, 3700, 3702, 3704, 3706, 3708, 3710, 3712, 3714, 3716, 3718, 3720, 3722, 3724, 3726, 3728, 3730, 3732, 3734, 3736, 3738, 3740, 3742, 3744, 3746, 3748, 3750, 3752, 3754, 3756, 37$

(7)

7) 2 5 8 11

8) Sex age

1 25

2 30

9) Sex smoking age.

1 0 21

1 0 22

2 0 23

2 0 24

2 0 25

1 1 26

1 1 27

1 1 28

2 1 29

2 1 NA

Problem ⑧

1) a) (7) All of 1, 2, 3, 4, 5

b) (7) All of 1, 2, 3, 4, 5

c) (5) aaaaaaaaaa.

2) George W. Bush.

(8)

Problem 9

1) ~~False~~ True.

2) True

3) False.

4) True.

5) False.

6) False.

Problem 10 a)

Basis: $\{x\}$ ist ein Element von A

$$\text{Voraussetzung: } \{x\} \in A$$

$$\{x\} \in \{x\}$$

$$\{x\} \subseteq \{x\}$$

(9)

Problem ② $P_A(x=H) = P(x=T) = 0.5$

Already two H & one T: H, H, T / T, H, H / H, T, H

50% H (Bob wins)

50% T (game continues)

Prob. that Bob will win = $50\% + 50\% \times 50\% = 75\%$

Prob that Alice will win = $50\% + 50\% = 25\%$

∴ Probability of Bob = 0.75

Probability of Alice = 0.25

Problem ④

(2) my_auc < function(df){

$tp = \text{count}(\text{df}[(\text{df}[\text{prob}] > 0.5 \& \text{df}[\text{label}] == 1)])$

$fn = \text{count}(\text{df}[(\text{df}[\text{prob}] > 0.5 \& \text{df}[\text{label}] == 0)])$

$fp = \text{count}(\text{df}[(\text{df}[\text{prob}] < 0.5 \& \text{df}[\text{label}] == 1)])$

$\text{auc} \cdot df = 1/2 ((tp / (tp + fn)) + (tn / (tn + fp)))$

return (auc · df)

3.