CS653 Homework Two

Zuodong Wu

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1 Question 1

1.1 Part a

Solution :

position	e	t	a	i	n	o	s	h	r	d
1	-20.614	19.861	-1.097	9.697	-2.313	1.233	-4.426	-0.069	-1.758	-0.514
2	-5.174	-3.729	11.162	-5.95	2.665	-3.841	-17.474	5.556	24.229	-7.444
3	6.861	-9.531	7.494	-6.572	-4.751	1.221	-8.027	0.881	9.138	3.286
4	24.668	-9.555	-3.154	-3.499	-12.169	-2.781	-2.541	-0.551	1.395	8.187

1.2 Part b

Solution :

The values are:

$$75.431, 63.29, 76.583$$

1.3 Part c

Solution :

The solution is

$$78.320, 63.290, 82.487$$

1.4 Part d

Solution :

file	character sequence	probability
1	trre	0.8274
2	net	1.0000
3	trehd	0.9597

1.5 Part e

Solution :

position	e	t	a	i	n
1	3.9e-18	1.0e+00	1.0e-09	5.3e-05	2.3e-10
2	2.4e-13	3.6e-13	3.3e-06	1.0e-13	3.1e-10
3	5.5e-02	4.6e-09	1.1e-01	7.5e-08	5.5e-07
4	1.0e+00	1.1e-15	7.7e-13	5.8e-13	8.1e-17

position	o	s	h	r	d
1	1.13-08	2.2e-11	2.2e-09	4.7e-10	1.3e-09
2	9.67-13	4.1e-19	1.0e-08	1.0e+00	1.2e-14
3	2.20-04	2.2e-08	1.8e-04	8.2e-01	1.8e-03
4	1.15-12	1.0e-12	9.1e-12	7.2e-11	5.3e-08

2 Question 2

2.1 Part a

Solution :

For C_1

	e	t	r
e	-20.985026	-20.493231	-20.325788
t	19.981769	19.207261	19.755592
r	-1.469788	-1.863408	-1.706481

For C_2

	e	t	r
e	-5.545026	-5.053231	-4.885788
t	-3.608231	-4.382739	-3.834408
r	24.517212	24.123592	24.280519

For C_3

	e	t	r
e	31.157974	-2.573231	8.544212
t	15.257769	-19.739739	-8.241408
r	34.094212	-0.522408	10.584519

2.2 Part b

Solution :

δ	e	t	a	i	n	o	s	h	r	d
1-2	19.982	19.207	20.142	19.915	19.573	20.07	19.483	20.227	19.756	19.609
δ	e	t	a	i	n	o	s	h	r	d
2-1	29.308	30.479	45.567	28.506	36.864	30.586	16.516	39.756	58.564	26.686

δ	e	t	a	i	n	o	s	h	r	d
2-3	44.273	43.879	44.186	44.206	43.895	44.205	43.662	43.895	44.036	43.805
δ	e	t	a	i	n	o	s	h	r	d
3-2	31.158	15.258	31.968	17.71	20.025	25.691	17.056	25.822	34.094	28.233

2.3 Part c

Solution :

For Y_1, Y_2

	e	t
e	8.323	9.986
t	49.289	49.686

For Y_2, Y_3

	e	t
e	45.595	30.186
t	46.757	30.082

For Y_3, Y_4

	e	t
e	75.431	41.7
t	59.137	24.14

2.4 Part d

Solution :

Y1

'3.92e-18', '1.00e+00', '1.07e-09', '5.34e-05', '2.38e-10', '1.13e-08', '2.28e-11', '2.24e-09', '4.78e-10', '1.32e-09'

Y2

'2.47e-13', '3.67e-13', '3.34e-06', '1.04e-13', '3.14e-10', '9.67e-13', '4.17e-19', '1.09e-08', '1.00e+00', '1.23e-14'

Y3

'5.56e-02', '4.67e-09', '1.15e-01', '7.52e-08', '5.57e-07', '2.20e-04', '2.27e-08', '1.83e-04', '8.27e-01', '1.87e-03'

Y4

'1.00e+00', '1.15e-15', '7.74e-13', '5.87e-13', '8.19e-17', '1.15e-12', '1.04e-12', '9.15e-12', '7.28e-11', '5.39e-08'

Y1,Y2

	e	t	r
e	6.13e-15	1.24e-21	2.23e-13
t	1.96e-14	1.12e-21	2.94e-13
r	5.56e-02	4.66e-09	8.27e-01

2.5 Part e

Solution :

The 5 predicted test sequences are

't', 'r', 'r', 'e'
'n', 'e', 't'
't', 'r', 'e', 'h', 'd'
'e', 'a', 's', 't'
's', 't', 'r', 'a', 'i', 't'

respectively.

The character-level accuracy is about 0.8986

4 Question 4

4.1 Part a

Solution :

$$\begin{aligned}\frac{\partial}{\partial x} f_w &= -2(1-x)\cdot(-1) - 100\cdot 2(y-x^2)\cdot(-2x) \\ &= 2 - 2x + 400xy - 400x^3\end{aligned}$$

$$\begin{aligned}\frac{\partial}{\partial y} f_w &= 2\cdot(-100(y-x^2)) \\ &= -200(y-x^2)\end{aligned}$$

4.2 Part b

Solution :

The location of the maximum is

$$x = 1.00000006,\ y = 1.00000011$$

The maximum value is 0.