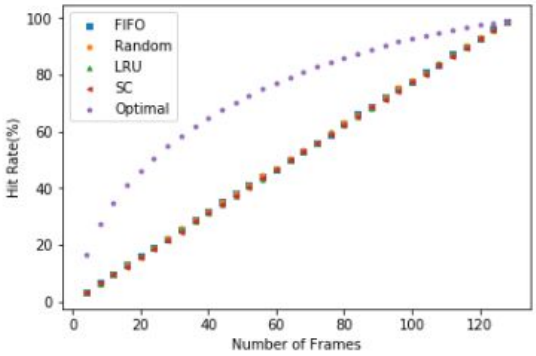
CS320 assignment 2 Masahiro Kiji

1. a) Hit rates for each policy when there is no locality

	OPT	SC	R	LRU	FIFO
4	16.63	3.44	3.12	3.12	3.27
8	27.41	6.49	6.34	6.16	6.70
12	34.88	9.43	9.60	9.48	9.92
16	40.97	12.26	13.12	12.59	13.05
20	46.18	15.47	15.75	15.86	15.92
24	50.70	18.40	18.84	18.99	18.99
28	54.75	21.69	22.30	22.12	21.90
32	58.40	24.51	25.88	25.20	25.37
36	61.73	28.11	28.68	28.19	28.77
40	64.86	31.20	31.68	31.23	31.99
44	67.66	34.17	35.00	34.44	35.06
48	70.24	37.41	38.05	37.25	37.97
52	72.70	40.30	41.10	40.46	41.15
56	74.98	43.60	44.81	43.34	43.95
60	77.13	46.64	46.90	46.49	46.57
64	79.08	49.96	50.52	49.98	50.08
68	80.96	53.08	53.22	52.76	53.13
72	82.76	56.10	56.09	55.80	55.90
76	84.42	59.02	60.00	59.09	58.98
80	86.01	62.35	63.23	62.33	62.77
84	87.49	65.33	65.57	65.03	66.12
88	88.93	68.64	68.41	68.23	68.86
92	90.28	71.27	71.90	71.42	72.14
96	91.54	74.01	75.33	74.42	74.94
100	92.70	77.35	77.90	77.42	77.31
104	93.75	80.13	80.60	80.44	80.92
108	94.79	83.63	83.72	83.87	83.62
112	95.77	86.42	86.87	86.90	87.10
116	96.66	89.53	90.46	89.83	89.79
120	97.48	92.61	93.30	92.60	92.84
124	98.16	95.58	95.69	95.61	96.01
128	98.72	98.72	98.72	98.72	98.72

b) The graph is

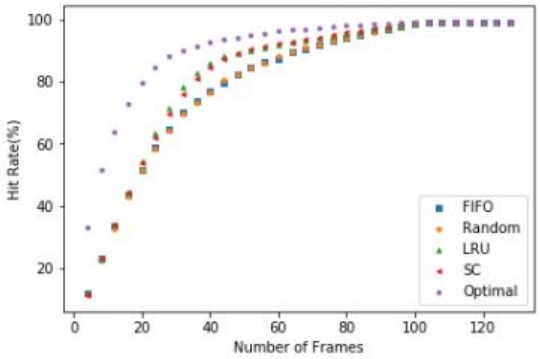


c) The results tell you that the optimal policy is better than the other policies. Especially, the difference is bigger when the number of frames is from 20 to 40. There is no difference in terms of hit rates among the other policies.

2. a) Hit rates for each policy when there is 80-20 locality

	OPT	SC	R	LRU	FIFO
4	33.19	11.64	11.33	12.18	11.82
8	51.71	23.35	23.16	22.97	23.28
12	63.97	34.01	32.66	34.23	33.60
16	72.85	44.25	43.04	44.61	43.50
20	79.58	54.04	51.50	54.39	51.67
24	84.56	62.15	58.45	63.28	58.82
28	87.87	69.53	64.43	71.43	64.61
32	89.99	76.11	69.51	78.15	70.13
36	91.40	80.97	73.41	82.88	73.83
40	92.50	84.64	76.46	85.85	76.94
44	93.43	87.36	80.56	87.90	79.69
48	94.17	89.13	82.41	89.03	82.27
52	94.84	90.30	84.42	90.03	84.27
56	95.44	91.40	85.72	90.81	86.28
60	95.98	92.11	88.09	91.62	87.38
64	96.43	92.70	89.47	92.41	89.27
68	96.85	93.40	90.72	93.16	90.56
72	97.25	94.13	91.86	93.80	91.51
76	97.58	94.76	93.24	94.64	93.04
80	97.90	95.62	94.02	95.25	93.79
84	98.20	96.18	94.84	95.92	94.80
88	98.42	96.88	95.97	96.63	95.98
92	98.62	97.59	96.85	97.26	96.72
96	98.79	98.23	97.71	97.91	97.56
100	98.93	98.81	98.55	98.68	98.49
104	98.98	98.98	98.98	98.98	98.98
108	98.98	98.98	98.98	98.98	98.98
112	98.98	98.98	98.98	98.98	98.98
116	98.98	98.98	98.98	98.98	98.98
120	98.98	98.98	98.98	98.98	98.98
124	98.98	98.98	98.98	98.98	98.98
128	98.98	98.98	98.98	98.98	98.98

b) The graph is

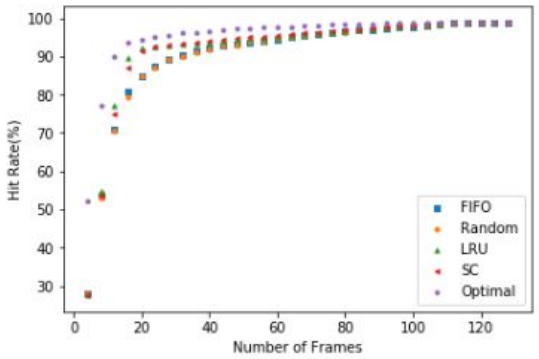


c) In general, the optimal policy is better than the others. Among non-optimal policies, LRU and SC have better hit rates than FIFO and Random by no greater than 10 points when the number of frames is from 20-80.The hit rates of LRU and SC are very similar, and those of FIFO and Random are also very similar. In addition, all the policies have better hit rates when there is 80-20 locality than when there is no locality.The number of frames gets more than 100, then the hit rates are almost the same among the policies.

3. a) Hit rates for each policy when there is 90-10 locality

	OPT	SC	R	LRU	FIFO
4	52.27	27.51	28.02	27.55	28.13
8	77.28	53.73	52.79	54.76	53.73
12	90.13	74.96	70.45	77.14	71.07
16	93.47	86.94	79.30	89.69	80.81
20	94.41	91.32	84.72	92.05	84.95
24	95.07	92.59	87.03	92.56	87.54
28	95.61	93.04	89.07	92.75	89.19
32	96.04	93.46	90.12	93.15	90.43
36	96.38	93.81	91.02	93.40	91.37
40	96.66	94.14	91.75	93.73	92.04
44	96.93	94.38	92.85	94.09	92.81
48	97.14	94.69	93.01	94.35	93.24
52	97.34	95.03	94.10	94.63	93.64
56	97.54	95.20	94.07	94.92	93.97
60	97.70	95.48	94.73	95.10	94.56
64	97.86	95.82	95.13	95.46	94.97
68	98.02	96.04	95.38	95.80	95.53
72	98.17	96.38	95.95	96.01	95.91
76	98.29	96.64	96.30	96.32	96.40
80	98.38	96.86	96.38	96.54	96.75
84	98.46	97.13	96.89	96.84	96.87
88	98.54	97.35	97.39	97.16	97.01
92	98.62	97.77	97.52	97.43	97.40
96	98.70	97.95	97.68	97.74	97.64
100	98.76	98.22	97.93	97.96	97.77
104	98.80	98.45	98.23	98.27	98.16
108	98.84	98.65	98.57	98.54	98.41
112	98.85	98.75	98.76	98.74	98.64
116	98.85	98.85	98.85	98.85	98.85
120	98.85	98.85	98.85	98.85	98.85
124	98.85	98.85	98.85	98.85	98.85
128	98.85	98.85	98.85	98.85	98.85

b) The graph is



c) Like 1. And 2, the optimal is the best policy. However, the difference between the optimal and SC/LRU got much smaller. Also, when the number of frames were between 20 and 40, SC/LRU is better than Random/FIFO. If the number of frames gets more than 40, there are not significant differences between SC/LRU and Random/FIFO. Like 2, If the number of frames gets more than 100, there are not significant differences among the policies.

4. a)

1) 0 1 2 3 4 5 6 0 1 2 3 7 0 1 2 3 4 5 6 7 5 6 7

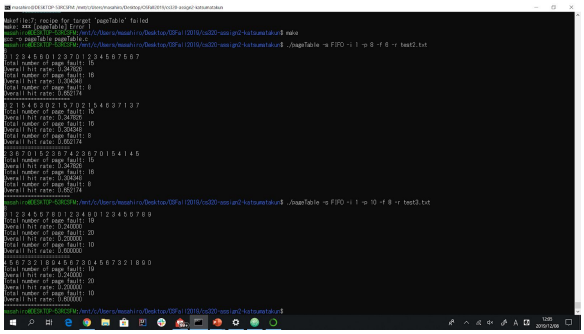
2) 0 2 1 5 4 6 3 0 2 1 5 7 0 2 1 5 4 6 3 7 1 3 7

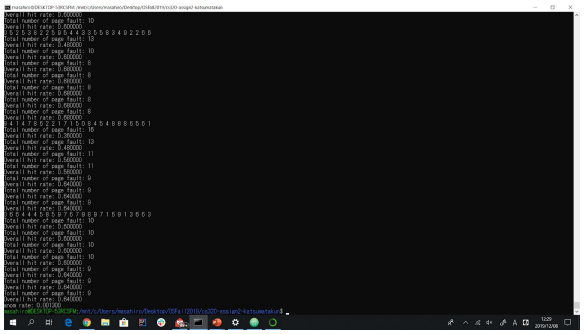
3) 2 3 6 7 0 1 5 2 3 6 7 4 2 3 6 7 0 1 5 4 1 4 5

4) 0 1 2 3 4 5 6 7 8 0 1 2 3 4 9 0 1 2 3 4 5 6 7 8 9

5) 4 5 6 7 3 2 1 8 9 4 5 6 7 3 0 4 5 6 7 3 2 1 8 9 0

These reference patterns cause Belady's anomaly.





b) When I simulated 10000 different random reference patterns the length of which is 25 and the number of pages of which is 10. I got Belady's anomaly approximately once in 1000 reference patterns or 0.1%.