1) Reference String: 1,2,3,4,2,1,5,6,2,1,2,3,76,32,1,23,6

a) LRU Replacement

-> 3 Frames

	£ 1	2	_ 3	, 4	2)	5	6	2		2	3	7	6	3	,2	, 1	૨	3	٦	
1	1	1	1	4	4	4	5	5	5	1	1	1	7	7	7	2	2	2	2	2	
2	and the same of th	2	2	2	2	2	2	6	6	6	6	3	3	3	3	3	3	3	3	3	
3			3	3	3	1	1-1	1	2	2	2	2	a	6	6	6)	1	1	٤	
			(1	H			-7-	-		Н		-		H			H	H		

Page Hit = 5 Hit ratio = 5/20 = 0-25

lage Mis = 15 Mis ratio = 15/20 = 0.75

4 Frames

	1	2	3	4	2	. 1	5	6	Z	1	2	3	7	6	3	2	1	2	. 3	6
201	1	1	l e	1	1		1	1	1	1	1	ī	Ī	6	6	6	6	6	6	6
2	-	2	2	2	2	2	2	2	2	2	२	2	2	2	2	2	2	2	2	2
3	- 1	e. <u>ė</u>	3	3	3	3	51	5	5	5	5	3	3	3	3	3	3	3	3	3
4			1	4	4	4	4	6	6	6	۵	6	7	7	7	7	1	1	1	1
					Н	H			·H	H	H				H	H		H	rt	Н

Page Hit = 10 Hit ratio = 0.5 Page Mis =10 Mis vetio = 0.5

5 Frames

	,	2	3	4	, 2	, 1	, 5	6	2	1	2	3	7 1	6	3	2	, 1,	2	3	6
1	T	. 1	1	100	1	1	ī	1	1	1	١	1	1	1	ì	1	1	1	Ì	3
2		2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
3	200		3	3	3	3	3	.6	6	8	6	6	۴	6	6	6	6	6	6	6
4		1.0		4	4	4	4 :	4	4	4	4	3	-3	3	3	3	3	3	3	3
5			1-1	E na		- idi	5	5	5	5	5	5	7	7	7	7	7	7	7	7
				v	H	Н			H	И	H	-		H	H	Н	H	H	H	H

Page Hit = 12

Hit ratio = 12

= 0.

Page Mis = 8

Miss ratio = 8

= 0.4

Scanned by CamScanner

Page Hit = 13 Hit ratio = 13/20 = 0.65

Page Miss = 7 Miss ratio = 7/20 = 0.35

b) FIFO Replacement

- 3 Frames

	. 1	2	, 3	4	2	.)	5	_	•											4
		1	1	L	L	L	14	1	1	1	1 2	3	7	۲	. 3	2	- 1	2	3	6
					'		9	-	6	6	6	3	3	3	3	2	2	2	2	6
2		2	2	2	2	1	1	ı	2	2	2	2	7	7	7	7	ı	1	1	
3			7		3				-			4		200						
			3	3	3	3	5	5	5	1	1	1	1	6	6	6	6	6	3	2
			1		H						H	-	- ola							
											• •				Н			1		

Page Hit = 4

Hit ratio = $4/2_0 = 0.2$

Page Mis = 16 Mis ratio = 0.8

-> 4 Frames

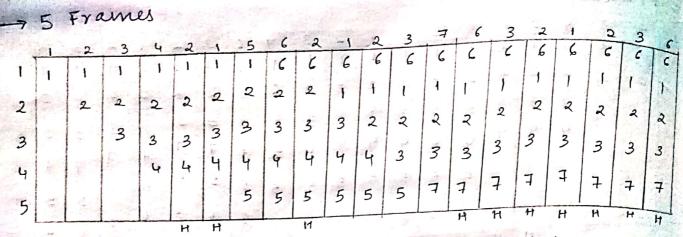
	<u></u>	2	, 3	4	, 2	, 1	5	6	2	. 1	. 2	3	7	6	2	و	,		_		
1	1	1	1	1	1	1	5	5	5	5	5	3	3	3	3	3	1	1	3	1	
2		2	2	2	2	2	2	6	6	6	6	6	7	7	7	7	7	7	3	3	
3			3	3	3	3	3	3	2	2	2	2	2	6	6	6	6	6	6	6	
4				4	4	4	4	4	4	1	1	1	1	t		2	a	2	2	q	
					H	H					H				H			H	-)

Page Hit = 6

Hit rictio = 6/20 = 0.3

Page Miss = 14

Miss ratio = 0.7



Page Hit = 10 Hit ratio = 0.5 Page Miss = 10 Miss ratio = 0.5

-> 6 Frames

							- 62				2	3	7	6	3	2	l	2	3	6
	1	2	3	4	2	. 1	5	6	2	+-	1	1	17	7	7	7	17	17	17	7
4	1	1	I was	114	1	1	1	1	J. L.	1	'	'		1	2					
		1-	196-1		2	2	2	2	2	2	2	2	2	2		2	1 1			
2		2	2	2	2			3	3	3	3	3	3	3	3	3	3	2	2	2
3			3	3	3	3	3			4	4	ч	4	4	4	4	4	4	3	9
4		2	4-1	4	4	4	4	4	4			5	5	5	5	5	5	5	5	5
	-	1 1	-15				5	5	5	5	5	٥))						
5	- 3	de		3.0	4	÷L.	-1 "		6	6	6	6	6	6	6	6	6	6	6	6
6	100	W. 1862		anne di		11	PLA	6		/5	out the		24	1	H	H	- 54			Н
1				176	L)	17			Н	·H	H	- H		• 1	1	j' je	31	1	21.4	1

Page Hit = 10 Hit vatio = 0.5

Page Miss = 10 Miss ratio = 0.5

c) Optimal Replacement

-> 3 Frames

	ı	2	3	4	2	1	, 5	6	a		2	3	7	6	3	2	1	2	3	6
1	T ₁	1	1	١	1	1	1	1	1	1	1	3	3	3	3	3	3	3	3	3
9		2	2	2	2	2	2	2	2	2	2	2	7	7	7	2	1 ,	2	2	2
3			3	4	4	4	5	6	6	6	6	6	6	G	6	36	<u> </u>	6	6	6
			100		H	H	-	البادر	1 H	H	H		-	H	H	-		•	H	H

Page Hit = 9

Hit Ratio = 0.45

Page Miss = 11

Miss ratio = 0.55

	14	Fre	rm	es				OTON	14(0)	30 (3	1659	MV.	1/2/	(1)	1111					
	1	2	3	4	2	1	5	6	د	,	'3	9	7	c	3	Э.	1	3-	3	(
		١	١	1	l	1	1	1	1	1	1	1	3	7	**	7	1	١	(1
	•	2	2	2	. 2	2	2	2	a	ಇ	2	2	2	2	2	2	ے	2	2	2
2			3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
3				4	4	4	5	C	c	c	c	6	۵	0	۵	c	G	6	(C
		1			Н	H	-	1	H	H	1	H		1-1	H	14	The second second	1-1	1:1-	Ч

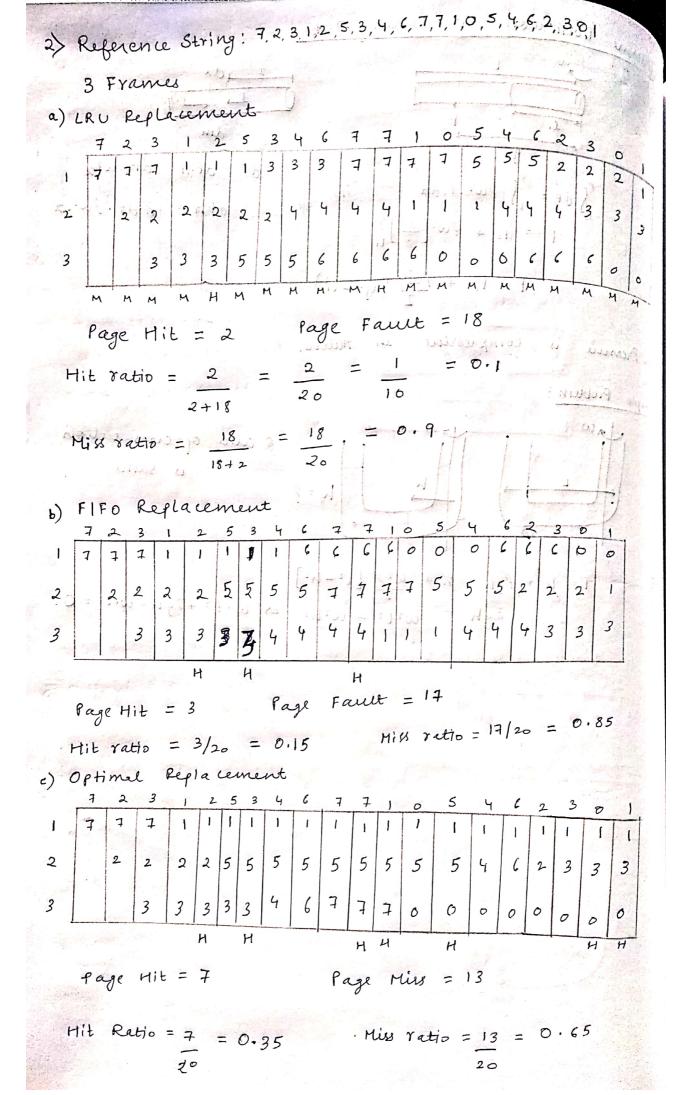
page Hit = 12 Hit ratio = 0.6 Page Mils = 8 Mils ratio = 0.4

-> 5 Frames

	, ,	-																		_	
	1	2	3	4	2	. 1	5	6	2	ī	2	3	7	6	3	2	. 1	2_	3_		
	<u> </u>	,	ı)	1	1	1	1	1	1	Ī	ī	1	1	1	1	1))	1	
. 1	'	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	
2			3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	
3				4	4	4	4	6	6	٥	6	۲	6	G	G	6	G	C	6		
4							5	5	5	5	5	5	コ	7	7	7	7	7	7	7	
5													-		1-1	H	FI	H	н	pol	
					H	H			H	H	14	H	41	Н	r'						

Page Hit = 13 Hit ratio = 0.65 Page Miss = 7 Miss ratio = 0.35

7 faults is the least we can have with 7 pages.



3> Refere	nce	stri	ng]] ₁	2,3	4,	5, 3,0	4,1,	۷, ٦	8.	7,8	, 9 , =	7 , 8	, 9,	5, 4	1,5	, 4	, 2		
3 11	Regia	cem	en	七														128	T	1
a) LRU	3	4	5	3	4	1	6	7	. 8	7	8	9	1	8	9	5	4	5	4	2
Til 1		9	4	4	4	4	4	7	7	7	7	1	17	7	7	5	5	5	5	5
2	2	٦	5	5	5	1	1	ı	8	8	8	8	8	8	8	8	4	4	4	4
	3	3	3	3	3	3	6	6	6	۲	6	9	9	9	9	9	9	9	9	2
3			i-	Н	.17	-		-		91 M	- 6			9	×.					ل ا
page 1	Hit =	= 9	9/2	ব), 1, 2 ,	6 0.1	age 10	٨	lių.	н =	н 13 Мі	4 5 8	H.	н 0 =	н 13	3/.	22	H = 0	н 9·6	o

b) FIFO Replacement

	1 2	3	4	5	3	4	١	G	ュ	5	· -				1		10	al po	1	Q-	11
	111	1	4	4	4	4	4	6	6	16	6	1	9	7	8	9	5	4	5	4	2
'				_					2	1		6	9	9	9	19	9	9	9	19	2
2	2	2	2	5	5	15	5	5	7	17	7	I	I	1	1	7	5	5	5	5	5
		130						7	2												
3		3	3	3	3	3	41	I	1	8	8	8	8	-8	8	<u>.</u> 5	8	4	4	14	4
+	91			-	Ы	Н	-		-	36		13				-					
					• (H	H		H	H	H	al l		H	H	

page Hit = 9

Hit retio = 0.40

Page Miss = 13

Mis ratio = 0.60

c) optimal Replecement

j	2	3	Ч	5	3	4	, Ľ	6	7	8	7	8	9	7	8	9	-5	4	. 5	4	2
1 1	1	1	١	5	5	5	5	5	5	5	5	5	9	19	9	19	9	9	9	9	5
1	2	2	4	4	4	٠ ٢	4	ب	4	8	8	8	8	8	8	్ది	8	4	4	4	4
3	i i	3	3	3	3	3		6	7	7	7	7	7	7	7	7	5	5	5	5	5
					H.	H			-		H	H		H	Н	Н			Н	11	

Page Hit = 9

Page Mill = 13

22

4) Reference 8ting: 1, 2, 3, 4, 2, 1, 5, 6, 2, 1, 2, 3, 7, 6, 3, 2, 1, 2, 3, 6

4 Frames

a) LRU Replacement

	211	ò	3	Ų	2	-1	5	6	2		2	3.	7	6	3	2	15	2	3	
1	at and the legislation		1	1	1	1	61	1	1	1	1	1	1	6	6	C	6	6	C	15
2	4.4		r je	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
3		2	3	Ŋ	3	3	5	5	5	5	5	3	3	3	3	3	3	3	3	2
4	7.6		2	4	4	4	4	6	C	6	٥	6	7	7	7	7	1	1	ı	1
		100			H	H			Н	11	H	Significant	1	ro U	1+	H		ЕН 🚦	H	7

Page Hit = 10 Hit ratio = 10/20 = 1/2 = 0.5 Miss ratio = 1/L = 0.5

Page Miss = 10

b) FIFO Replacement

	137	2	3	4	2		5	6	2	1	2	3	7	6	3	2	-1	2	3	
1	1	1	1-1		١	1	5	5	5	5	5	3	3	3	3	3	1	ſ	T	
2	1	2	2	2	2	2	2	-6	6	6	6	6	Ŧ	7	7	7	I	ī	3	3
3	F 3	į.	3	3	3	3	.3	3	2	2	2	2	2	6	6	6	C	6	6	4
4	- C	- ₅₄ 4	RALL	4	4	4	4	4	4	1	1	((4		2	2	2	2	2
					H	H	E do de	A.I		-	H	-	of the Car		H	12		H.		H

Page Hit = 6 Hit Ratio = 6/20 = 0.3

Page Mis = 14 ris retio = 14/20 = 0.7

comment by a disturb

c) Oftimal Replacement

	1	2	3	34	2	1	5	6	2	1	2	3	7	G	3	2	.1	2	3	6
A	11	A _(a)	1	11	1	1	P.T	- 1	. 1	T	1	H ₃	7	7	7	7	T	ala di		
2		2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
3	9	er .	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
4			etel etel	4	4	Ч	5	6	6	6	6	6	6	6	6	G	6	-6	6	6
					H	Н			Н	H	14	Н	3	H	Н	Н		И	Н	11

Page Hit = 12

Page Miss = 8 - 111 mm