5.8.1, 5.8.2, 5.8.3, 5.8.4, 5.9.1, 5.9.3, 5.10.1, 5.10.4, 5.11.1, 5.11.3, 5.12.2, 5.15.2

Chris Bero

HW 7

CPE 431

5.8.1 $MTBF = MTTF + MTTR$ $\quad Availability = \frac{MTTF}{(MTTF + MTTR)}$

$MTTF = 3\ yr \quad MTTR = 1\ Day \quad \boxed{MTBF = 1096\ days}$

5.8.2 $Availability = \frac{MTTF}{MTBF} = \boxed{\frac{1095}{1096}} \approx 1.001$

5.8.3 As $MTTR \to 0$ the Availability $\to 1$. This can be reasonable from the viewpoint of RAID systems.

5.8.4 As MTTR increases, availability diminishes. This directly indicates that a device with higher MTTR has lower availability.

5.9.1 128-bit word, SEC/DED $\quad p \geq \log_2(p + d + 1)$

$p \geq \log(p + 129) \quad 2^p \geq p + 129$

$2^8 = 256 \geq 137$

$\boxed{8\ \text{parity bits}}$

5.9.3 SEC code, 8bit words / 4 parity bits, have $0x375$

$0011\ 0111\ 0101_2$

P1	P2	d1	P3	d2	d3	d4	P4	d5	d6	d7	d8
0	0	1	1	0	1	1	1	0	1	0	1

Parity: 1100, error in bit 12 → d8

Corrected data: 10110100_2

5.10.1

Page Size	Page Utility	Access Cost	Utility/cost
2048	3.49	10.2	0.34
4096	4.49	10.4	0.43
8192	5.49	10.8	0.50
16384	6.49	11.6	0.55
32768	7.49	13.2	0.56
65536	8.49	16.4	0.51
131072	9.49	22.8	0.41
262144	10.49	35.6	0.29

Best page size is now 32KiB.

5.10.4

$$\frac{(\$/MB)}{(pages/MB)} = \frac{(\$/Disk)}{(Accesses/s) * x} \qquad x = \frac{(pages/MB)(\$/Disk)}{(\$/MB)(Accesses/s)}$$

1987: $\frac{5000}{1000} = \frac{15{,}000}{15x} \Rightarrow 5000(15x) = 1000(15{,}000)$ $\boxed{x = 200}$

1997: $\frac{15}{125} = \frac{2000}{64x}$ $15(64x) = 125(2000)$ $\boxed{x = 260}$

2007: $\frac{0.05}{16} = \frac{80}{83x}$ $0.05(83x) = 16(80)$ $\boxed{x = 308}$

5.11.1

VP PP

Valid	Tag	PPN
1	0	5
1	8	D
1	3	6
1	11	12

	Valid	Physical Page
0	1	5
1	0	D
2	0	D
3	1	6
4	1	9
5	1	11
6	0	D
7	1	4
8	0	D
9	0	D
10	1	3
11	1	12

a. 4669 → 0x123D
0001 | 0010 0011 1101
VPN: 1
Page Fault

a. 2227 → 0x8B3
0000 | 1000 1011 0011
VPN: 0
Page table hit

a. 13916 → 0x365C
0011 | 0110 0101 1100
VPN: 3
TLB hit

a. 34587 → 0x871B
1000 | 0111 0001 1011
VPN: 8
Page fault

a. 48870 → 0xBEE6
1011 | 1110 1110 0110
VPN: 11
Page table hit

a. 12608 → 0x3140
0011 | 0001 0100 0000
VPN: 3
TLB hit

a. 49225 → 0xC049
1100 | 0000 0100 1001
VPN: 12
Invalid Page