1 step 1 Chapter 5.11

a) Given data
virtual address = 32 bits
PTE size = 4 bytes
Page table entries (PTE) = Virtual address - page size
= 32 - 13 (8 KB)
= 19 bits or 512 entries

step 2
Physical memory = PTE x PTE size
= 512 x 4
= 2048 or 2 MB

step 3
(b) Given data:
virtual address = 64 bits
Page size = 4 KB
PTE size = 8 bytes
Page table entries (PTE) = Virtual address - page size
= 64 - 12 (4 KB)
= 52 bits or 2^{52} entries

step 4
Physical memory = PTE x PTE size
= $2^{52} \times 2^3$
= 2^{55} bytes

2 from 5.11

step 1

a) Given data

Virtual address = 32 bits

Page size = 8 KB

PTE size = 4 bytes

Page table entries (PTE) = Virtual address - page size

= 32 - 13 (8 KB)

= 19 bits or 512 entries

step 2

8 KB page / 4 byte PTE = 2^{11} pages indexed per page

Hence with 2^{19} PTE's will need 2-level page setup

Each address translation will require at least 2 physical memory access.

step 3

(b) Virtual address = 64 bits

Page size = 4 KB

PTE size = 8 bytes

Page table entries (PTE) = Virtual address - page size

= 64 - 12 (4 KB)

= 52 bits or 2^{53} entries

step 4

4 KB page / 8 byte PTE = 2^{9} pages indexed per page

Hence with 2^{52} PTE's will need 6-level page table setup

Hence address translation will require at least 6 physical memory access

3 from 5.11

a) step 1

Given data

virtual address = 32 bits
Physical DRAM = 4GB
Page size = 8 KB and
PTE size = 4 byte
Number of PTE = 32-24
= 8 bits

step 2

Therefore 512 K PTE's are needed to store the page table

In common case: no hash conflict, so one memory reference per address translation.

In worst case: 512 memory references are needed, if hash table degrade into a link list.

step 3

(b) Given data

virtual address = 64 bits
Physical DRAM = 16 GB
Page size = 4 KB
PTE " = 8 byte
Number of PTE = 64 - 12
= 52 bits

Therefore $2^{(34-12)}$ PTE's are needed to store the page table

In common case: no hash conflict. So one memory reference per address information

In worst case: $2^{(34-12)}$ memory references are needed if hash table degrade into link list