Map Virtual to Physical

Mapping a virtual address to a physical address is relatively easy once the correct formulas are known. There are also some pieces of information that you will need, such as the page size and a page table.

There are four steps to converting a virtual address to a physical address:

1. Calculate the page (Note: integer division is used for this):

$$page = \frac{virtual\ address}{page\ size}$$

2. Calculate the page offset (Note: $\%$ is the modulus operator):

$$offset = virtual\ address\ \%\ page\ size$$

3. Find the frame by mapping the page to a frame via the page table
4. Calculate the physical address:

$$physical\ address = frame * page\ size + offset$$

It is not always possible to get a physical address from a virtual address. If the page table has a page listed as *invalid*, then a segmentation fault would occur, instead of accessing the physical address.

Q: Given the following page table, map the (base 10) virtual addresses to physical addresses.
Virtual Addresses: 500, 8200, 102400
(2011 Mid semester exam, Q15)

Relevant information: Page size is 4KB (4096B)

Page	Frame
0	200
1	201
2	22
3	invalid
...	invalid
25	24
...	invalid

For each of these virtual addresses, we need to calculate the physical address using the process outlined above.

Virtual address 500:

$$page = 500/4096 = 0$$

$$offset = 500\ \%\ 4096 = 500$$

From our page table, we can see that page 0 maps to frame 200.

$$physical\ address = 200 * 4096 + 500 = 819700$$

Virtual address 8200:

$$page = 8200/4096 = 2$$

$$offset = 8200\ \%\ 4096 = 8$$

From our page table, we can see that page 2 maps to frame 22.

$$physical\ address = 22 * 4096 + 8 = 90120$$

Virtual address 102400:

$$page = 102400/4096 = 25$$

$$offset = 102400\ \%\ 4096 = 0$$

From our page table, we can see that page 25 maps to frame 24.

$$physical\ address = 24 * 4096 + 0 = 98304$$

From this, we can see that it is possible to get a physical address for every virtual address we were asked to convert. This means that there were no segmentation faults.

It is possible for a page fault to occur, but we have not been given enough information to determine whether this is the case.