# BPOS: Excercises for week 9

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## Solutions

1. (a) Let:
$$RF \in \{gpr, spr\}$$
If machine $vm(u)$ is running, then each register $gpr(i_5)$ is found in the corresponding register of the host:
$$cvm.vm(u).gpr(i_5) = d.gpr(i_5)$$

   (b) If user machine $vm(d, c, u)$ is suspended, then each general-purpose register $gpr(i_5)$ is found in the corresponding entry of its process control block:
$$cvm.vm(u).gpr(i_5) = va(PCB[u].gpr[i], k)_{32}$$

   (c) CVM concrete kernel (I2OS-31), slide 39
   Definitions:
   - running: the hardware registers
   - suspended: the saved registers in PCB

2. (a) If machine $vm(u)$ is running, then each special purpose register $RF(i_5)$ is found in the corresponding register of the host. The program counter is found in the $pc$ of the host:
$$vmrun(d, k, u).spr(i_5) = d.spr(i_5)$$
$$vmrun(d, k, u).pc = d.pc$$

   (b)
$$cvm.vm(u).eca = va(PCB[u].spr[2], k)_{32}$$
$$cvm.vm(u).edata = va(PCB[u].spr[4], k)_{32}$$
$$cvm.vm(u).sr = va(PCB[u].spr[1], k)_{32}$$
$$cvm.vm(u).pc = va(PCB[u].spr[3], k)_{32}$$

   (c) CVM concrete kernel (I2OS-31), slide 39
   Definitions:

- running: the hardware registers
- suspended: the saved registers in PCB

3. (a)
$$cvm.vm(u).m(a) = d.m(pma(k, u, a))$$
(b)
$$cvm.vm(u).m(a) = byte(\langle a.bx \rangle d.sm(sma(u, a.px)))$$
(c) CVM concrete kernel (I2OS-31), slide 39,
Definitions:
   - Swap memory base (page) address

4. Unlike *sr* and *pc* which get saved into *esr* and *epc* if an interrupt occurs, *eca* and *edata* are not.