1 Register machine A

Give a full description of a register machine RM_A that, on input x in register 1, halts when x is equal to 2 modulo 5 and never stops otherwise. (Note, all other registers are empty. The same goes for the other machines in the other exercises.)

2 Register machine B

What does the following register machine do on input x in register r_1, s_1 being the starting state? Briefly explain your answer.
$RM_B = (\{s_1, s_2, s_3\}, \{r_1, r_2\})$
Where s_1 is the instruction $s_1 : r_1 - -; s_2; s_3$, the instruction s_2 is defined as $s_2 : r_2 + +; s_1$ and the instruction s_3 is the halting state.

3 Register machine C

Give a description[1] of a register machine RM_C that, on input x in register 1, increases some register r_i to the value $\binom{x}{2}$ and sets all other registers equal to zero before halting.

4 Register machine D

What does the following register machine do on input x in register r_1, where s_a is the starting state? Briefly explain your answer.
$RM_D = (\{s_a, s_0, s_1, s_2, s_3, s_{c1}, s_{c2}, s_{stop}\}, \{r_1, r_2, r_3\})$
Where we have:
$s_a : r_2 + +; s_0$
$s_0 : r_1 - -; s_1; s_{stop}$
$s_1 : r_2 - -; s_2; s_{c1}$
$s_2 : r_3 + +; s_3$
$s_3 : r_3 + +; s_1$
$s_{c1} : r_3 - -; s_{c2}; s_0$
$s_{c2} : r_2 + +; s_{c1}$
$s_{stop} : STOP$

[1] A full description of the machine can be rather lengthy, so it suffices to describe what the machine does while making clear that it is possible to do this on a register machine.