Here are the steps you'll need to follow:

REQUIREMENTS: SystemVerilog, Git, Linux, independence

DESCRIPTION:

1. Set-up: Fork and clone X-HEEP. You need to work in your forked copy of X-HEEP as the exercise needs to be submitted as a PULL REQUEST to the X-HEEP main repository.

Install all the tools required and run with Verilator the application “hello world”.

Follow the X-HEEP documentation available at:
https://x-heep.readthedocs.io/en/latest/index.html

If any of the documentation is not clear, let us know by proposing how to improve it.

2. Design a hardware peripheral in SystemVerilog: This peripheral must read two values from its register file, sum them, and write the result back into the register file. The addition and write-back of the result to the register file are enabled by setting a START flip-flop via a memory-mapped write operation.

The memory-mapped operations come from the register interface (*reg_req_i* and *reg_rsp_o* below) whose protocol is described here: https://github.com/pulp-platform/register_interface

The peripheral must have the following interface:

```
module add_two_number #(
    parameter type reg_req_t = logic,
    parameter type reg_rsp_t = logic
) (
    input logic clk_i,
    input logic rst_ni,
    input  reg_req_t reg_req_i,
    output reg_rsp_t reg_rsp_o
);

      // YOUR CODE GOES HERE //

endmodule
```

3. Integrate it into the X-HEEP Peripheral Subsystem: Ensure the peripheral is properly connected and communicating with the microcontroller.
This requires quite a lot of independent understanding of how X-HEEP works. You need to add the information of the peripheral in several files so that it can be compiled and addressed by memory operations correctly. This requires modifying both the HW and SW of X-HEEP.

4**. Develop the software in C:**

Create an application in C code:

a. Initialize the peripheral by writing to its register file two values.
b. Enable the addition and write-back by writing to the “start” flip-flop of the peripheral.
c. Read the result and compare it with the expected value.

5. Create a pull request to the X-HEEP main repository:

Make sure the tests pass and you document the pull request.

If you have any questions or need further clarification, feel free to reach out. Good luck with your project!

TIPS: you can find most of your answers in the code itself and in the documentation, just have a look at how the other peripherals are integrated!