Homework #5

Due: March 15, 2024 **Points:** 100

Questions

1. (*30 points*) Let $L = (S_L, \leq_L)$ be a lattice. Define:

   (a) $S_{IL} = \{[a,b] \mid a,b \in S_L \wedge a \leq_L b\}$

   (b) $\leq_{IL} = \{([a_1,b_1],[a_2,b_2]) \mid a_1 \leq_L a_2 \wedge b_1 \leq_L b_2\}$

   (c) $lub_{IL}([a_1,b_1],[a_2,b_2]) = (lub_L(a_1,a_2), lub_L(b_1,b_2))$

   (d) $glb_{IL}([a_1,b_1],[a_2,b_2]) = (glb_L(a_1,a_2), glb_L(b_1,b_2))$

   Prove that the structure $IL = (S_{IL}, \leq_{IL})$ is a lattice.

2. (*30 points*) The following system call adds read permission for a process (*for_pid*) if the caller (*call_pid*) owns the file, and does nothing otherwise. (The operating system supplies *call_pid*; the caller supplies the two latter parameters.)

```
function addread(call_pid, for_pid: process_id; fid: file_id): integer;
begin
        if (call_pid = filelist[fid].owner) then
                addright(filelist[fid].access_control_list, for_pid, "r");
        result := (call_pid - filelist[fid].owner);
        return result
end.
```

   (a) Is the variable `result` directly or indirectly visible, or not visible?

   (b) Is the variable `filelist[fid].owner` directly or indirectly visible, or not visible?

   (c) Is the variable `filelist[fid].access_control` directly or indirectly visible, or not visible?

3. (*40 points*) Section 18.3.2.3 derives a formula for $I(A;X)$. Prove that this formula is a maximum with respect to p when $p = \frac{M^{\frac{1}{m}}}{1+mM^{\frac{1}{m}}}$, with M and m as defined in that section. (The value of p in the book is incorrect.)