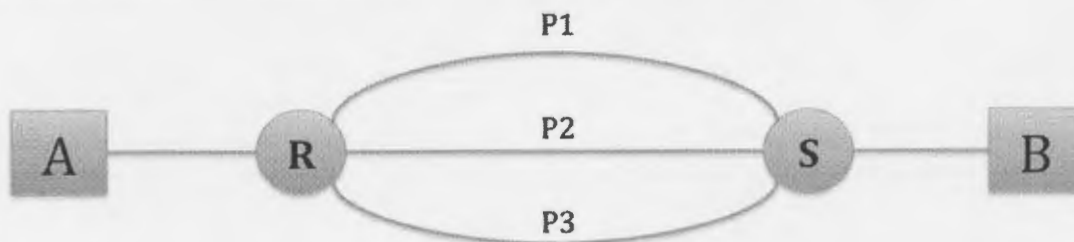


Please write readably.

There are three classes of questions: (a) expecting (relatively) short answers, (b) expecting more elaborate answers, and (c) a small design task. The questions are marked accordingly.

Questions:

1. [6p, a] Describe two issues that require special consideration when employing a NACK-based reliability in a protocol. (How) can relaxing reliability requirements help?
2. [6p, a] Using multicast makes data encryption more complex than it is with a unicast protocol. Why?
3. [6p, a] Which options for limiting resource consumption in the network are available to a protocol designer? Sketch one approach with and one without network support.
4. [6p, a] a) Explain head-of-line blocking.  
b) How can you avoid this issue in your protocol design and implementation?
5. [6p, b] a) Explain the end-to-end principle.  
b) Choose one type of *intermediary* and discuss its impact on the end-to-end principle.
6. [6p, a] Which advantage(s) do you get when encoding numbers in fixed-sized binary encoding? Which issue(s) may arise?
7. [6p, b] Compare topological (e.g., hierarchical) addressing and flat address spaces with respect to supporting node mobility and multi-homing (for redundancy).
8. [12p, c] Consider the following networking topology comprising two endpoints A and B (there may be hundreds on each side), two routers R and S, and three paths P1, P2, and P3. The endpoints want to communicate using a transport protocol, with A the sender and B the receiver, via the routers R and S (again, in a complex topology there would be many) so that the endpoints can choose which path(s) to take and how to spread the load if multiple paths are available.



- a) Outline a transport protocol that could make conscious use of the network topology.
- b) Which kind of interaction with the network would you foresee? How would you realize those?
- c) Sketch an API or transport abstraction for the applications to use this transport.

(Note: There are many possible solutions.)