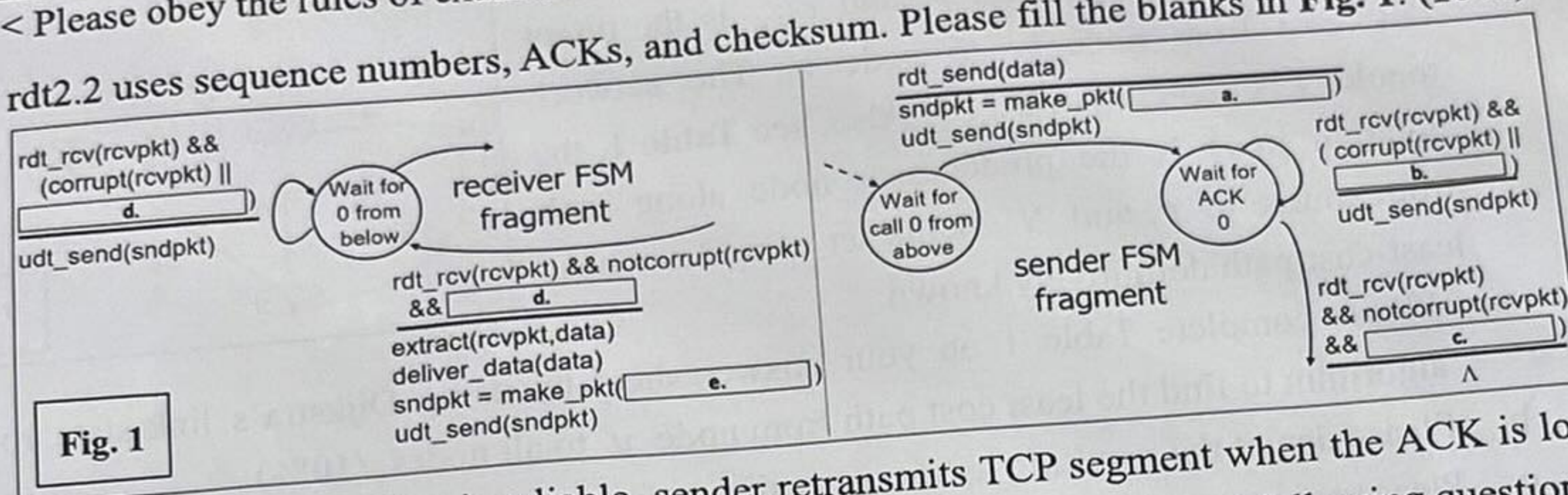


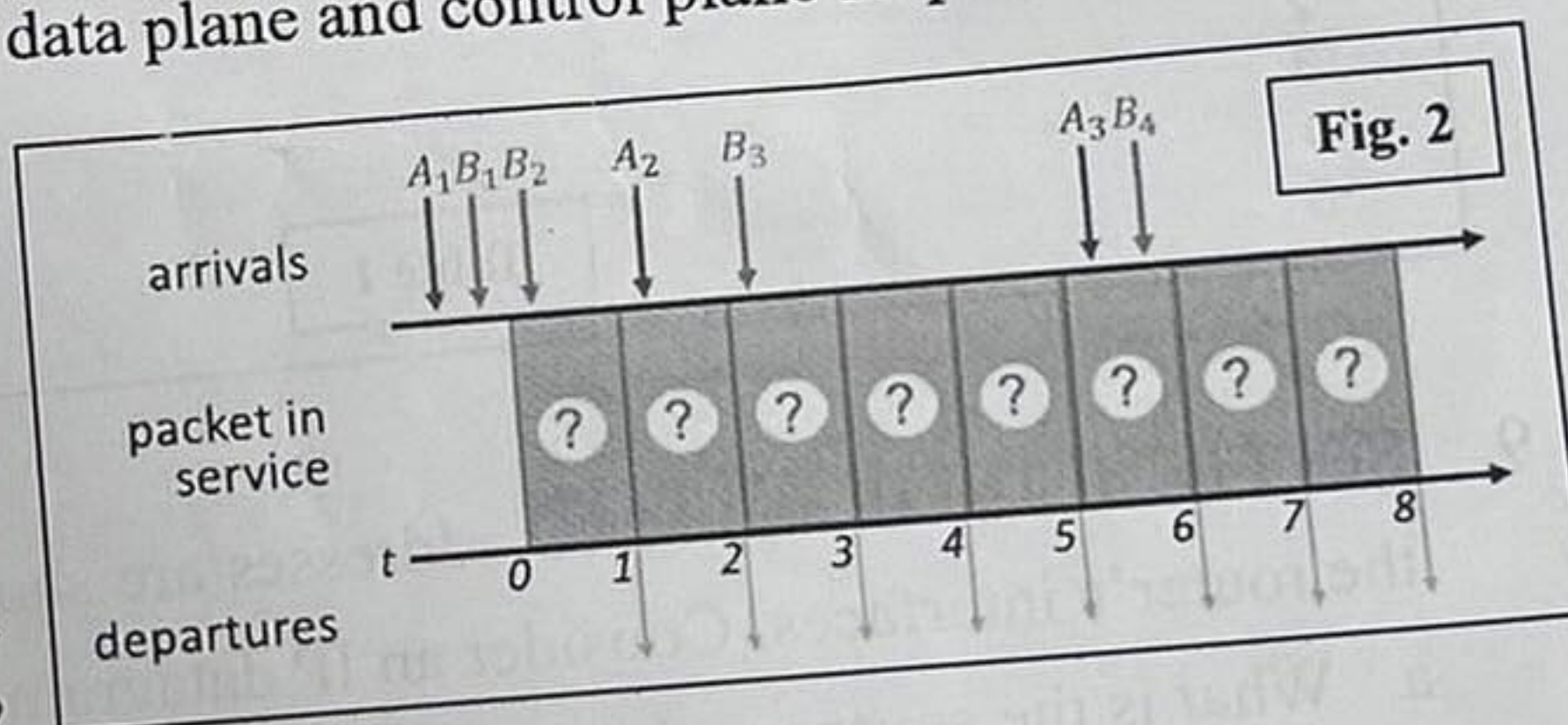
< Please obey the rules of examination and do not use any Internet-connected devices. >

1. rdt2.2 uses sequence numbers, ACKs, and checksum. Please fill the blanks in Fig. 1. (10%)



2. Suppose TCP connection is reliable, sender retransmits TCP segment when the ACK is lost, and sender can proceed fast retransmit before TimeoutInterval. Answer following questions.
- How does the sender judge that it can proceed fast retransmit before timeout? (5%)
 - Which TCP segment should be resent while the fast retransmit scheme is launched? (5%)
3. In network layer, what is the function of data plane and control plane respectively. (7%)

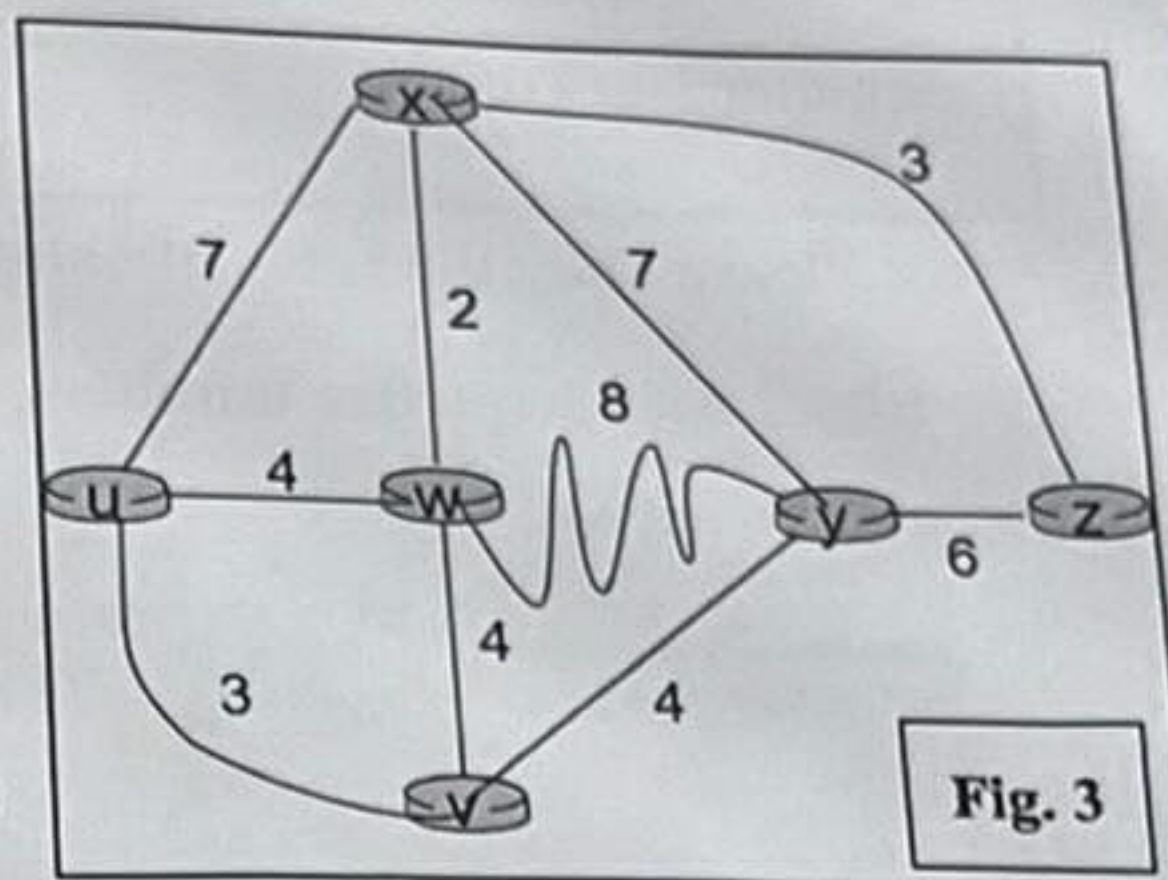
4. See Fig. 2. Pattern A has higher priority than the pattern B. The lower index has higher priority if two packets are with the same pattern. What is the departing packet in each time slot based on priority scheduling?



- Note: if there isn't the packet transmitted in the time slot, fill 'X'. (8%)
- What is the functionality and purpose of Internet Control Message Protocol (ICMP)? Why network users need ICMP? (5%)
 - Service Level Agreement (SLA) is important to service quality. If an Internet service is set to "four nines", what is the maximum total downtime per week in seconds? (10%)
 - A datagram (D) 110101 is to be sent, and the generator (G) 101 is given. We already know that the Cyclic Redundancy Check (CRC) bits is $R = \text{remainder} \left[\frac{D \cdot 2^r}{G} \right]$.
 - Please find out the CRC bits. Hint: by mod 2 operations. (10%)
 - If no error occurs, what datagram (in bits) will the receiver receive? Hint: If no error, the received datagram should be divisible by the generator. (5%)

< Please obey the rules of examination and do not use any Internet-connected devices. >

8. Use Dijkstra's link-state routing algorithm, known that $D(v) = \min(D(v), D(w) + c_{w,v})$, where $D(v)$ is the current cost estimation of the least-cost-path from source to destination v , and $c_{w,v}$ is the direct link cost from node w to node v . The network topology is depicted in Fig. 3. Also, see Table 1, the notation $p(v)$ is the predecessor node along path from source to v , and N' is the set of nodes whose least-cost-path definitively known.



- Please complete Table 1 on your answer sheet by using Dijkstra's link-state routing algorithm to find the least cost path from node u to all nodes. (10%)
- Please depict the resulting least-cost-path tree from node u . (5%)
- Please complete the resulting forwarding table (Table 2) in node u . (5%)

Step	N'	v $D(v), p(v)$	w $D(w), p(w)$	x $D(x), p(x)$	y $D(y), p(y)$	z $D(z), p(z)$
0						
1						
2						
3						
4						
5						

Table 1

destination	outgoing link
V	(,)
W	(,)
X	(,)
Y	(,)
Z	(,)

Table 2

9. See Fig. 4. The IP and MAC addresses are shown for nodes A, B, C and D, as well as for the router's interfaces. Consider an IP datagram being sent from node C to node B.
- What is the source and destination mac addresses of at point 6? (5%)
 - Do the source and destination mac addresses change at point 3? Answer with yes or no and briefly explain the reason. (5%)
 - What is the source and destination mac addresses of at point 3? (5%)

