1.

a) Circuit switching
   i) 72
   ii) No
   iii) 34
   iv) Yes

b) One-hop transmission delay
   i) 0.00008
   ii) 12500

c) End to End delay
   i) 0.000004
   ii) 0.0000033
   iii) 0.0000073
   iv) 0.0004
   v) 0.0033
   vi) 0.0037
   vii) 0.000004
   viii) 0.00001
   ix) 0.000014
   x) 0.0038

d) End to End throughput
   i) 50
   ii) R
   iii) 0.625
   iv) 0.5
   v) 1

e) The IP Stack and Protocol layering
   i) Physical layer
   ii) Network layer
   iii) Link layer
   iv) Application layer
   v) Transport layer
   vi) Application layer
   vii) Transport layer
   viii) Network layer
   ix) Link layer
   x) Physical layer
   xi) Physical layer
   xii) Link layer
   xiii) Physical layer

xiv) Link layer
xv) Network layer
xvi) Physical layer
xvii) Link layer
xviii) Network layer
xix) Transport layer
xx) Application layer

2.

R11.

Total e2e delay = (L/R1) + (L/R2)

R12.

A circuit-switched network is more reliable than a packet-switched network, specifically in regards to the fact that with packet-switching excessive congestion is possible which is a catalyst for packet delay and loss. TDM does not rely on guard bands, meaning that it is generally more efficient and flexible.

R16.

The delay components in end to end delay are processing delay, queuing delay, transmission delay, and propagation delay. Considering that we are just concerned with the sending of a specific packet, the only delay that is variable is queuing delay as we are depending on the congestion level of the router. All others will be constant, but will change depending on the size of the input packet.

P2.

(N + P -1) (L/R)

P3.

a. A circuit switched network is better, as it will perform more reliably for constant and relatively steady streams of data. Packet switching is better suited for bursty data, which does not align well with the described use case
b. No congestion control will be needed, as the sum of the application data rates is less than the capacities of each and every link.

P13a.

((N-1)L)/(2R)

P31.

a. 0.6 seconds
b. The first packet takes 0.002 seconds to arrive at the switch. Second packet received at the switch after 0.004 seconds
c. Takes 0.204 seconds with segmentation and 0.6 seconds without segmentation.