ECE 697J
Midterm Exam

Name:_____

	Maximum	Achieved
Question 1	12	
Question 2	12	
Question 3	12	
Question 4	30	
Question 5	14	
Question 6	8	
Question 7	12	
Total	100	

Please write legibly! Be concise. Unreadable answers will not be graded.

Time: 75 minutes

Question 1 (12 points (3+3+3+3)):
Answer the following general questions regarding Active Networks

a) What is an Active Network and how is it different from a traditional network? What problem does Active Networking address?

b) There are several approaches to Active Networking. One is the “capsule” approach another is the “programmable switch” approach. Explain each and compare the differences. Discuss the benefits and drawbacks of each.

c) What additions to packet headers are necessary to support Active Networking? Specifically, how is this handled in an IP network?

d) What are the differences between traditional routers and active routers? What functions does an active router have to support?

Question 2 (12 points (6+6)):
Answer the following questions regarding Active Network router architectures:

a) Describe how ANTS, Smart Packets, and the Active Network Node are implemented. Distinguish between software/operating system issues and hardware issues.

b) Contrast these three systems regarding the following characteristics:
    a. Scalability

    b. Performance

    c. Ease of programming

    d. Security

Question 3 (12 points (4+4+4)):
Answer the following questions regarding Active Reliable Multicast and Overlay Multicast.

a) Describe how Active Reliable Multicast (ARM) works and contrast it to Scalable Reliable Multicast (SRM). What performance aspects are better in ARM?

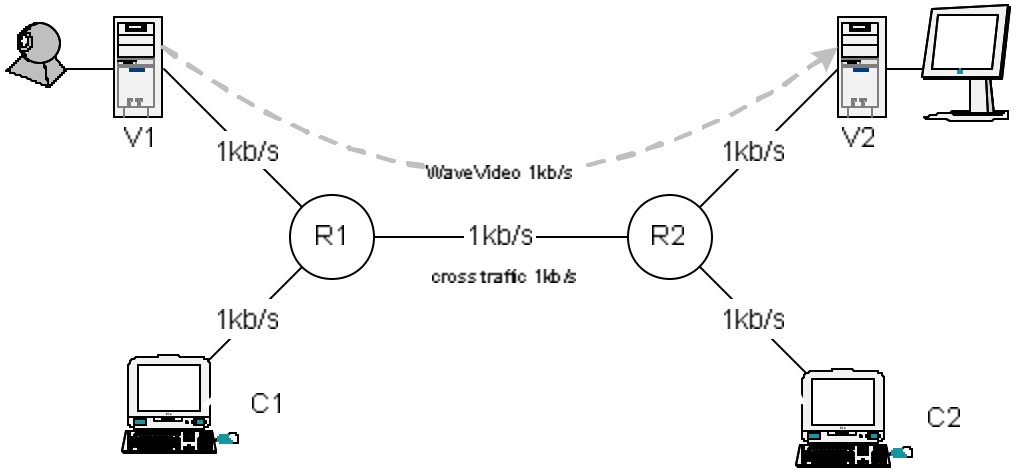
b) Describe how Overlay Multicast (OM) is implemented

c) Discuss the benefits and drawbacks of OM over IP multicast.

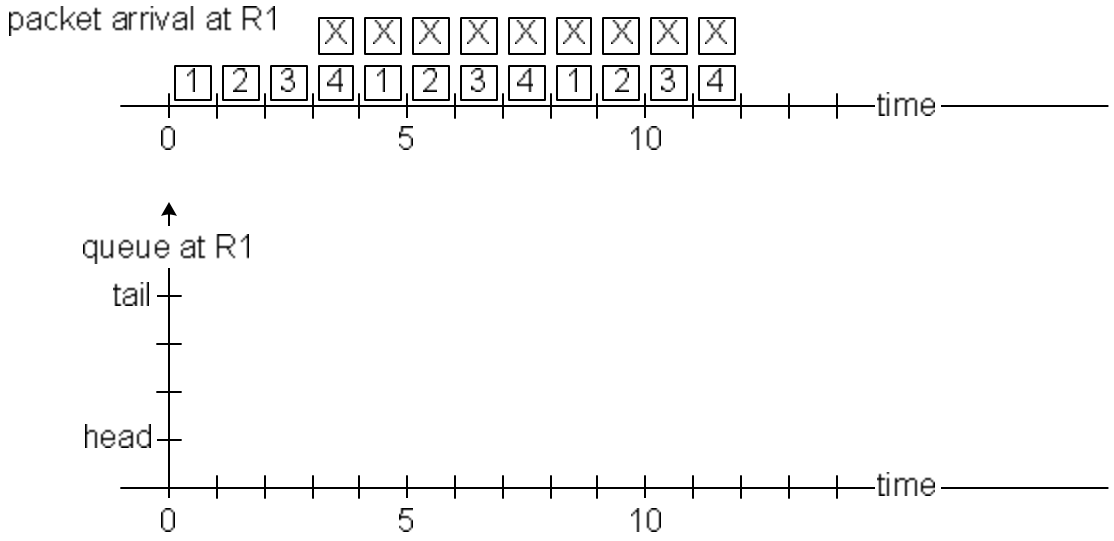
Question 4 (30 points (3+10+2+5+10)):
Answer the following questions regarding the Wave Video application.

a) What is the idea behind WaveVideo over active networks? Why is particularly useful for video multicast?

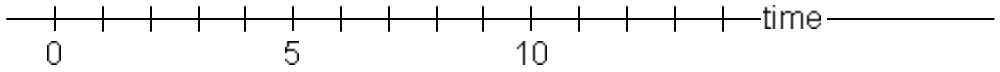
b) Assume the following scenario:



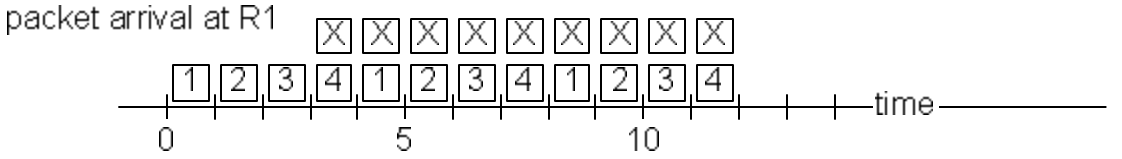
Assume the video transmission starts at time 0 and cross traffic starts at time 3. All sources stop sending at time 11. Then the arrival of packets on router R1 is shown below. Show the state of the packet queue at router R1 (show the packets as boxes). Also, show the WaveVideo packets that arrive at a given time at V2:

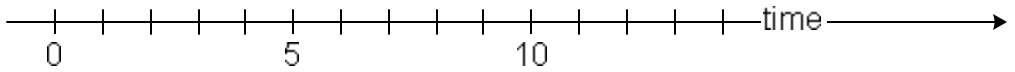


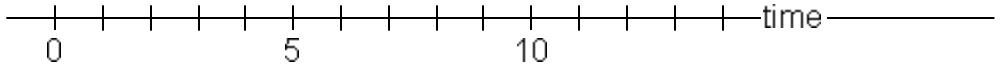
packet arrival at V2

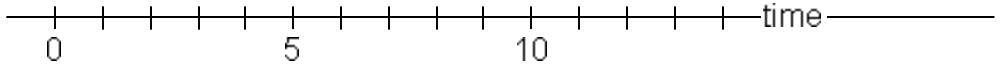


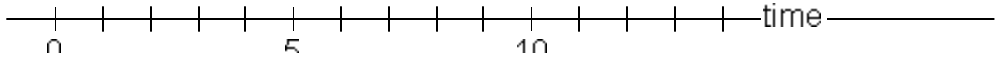
e) Show how your solution works using the above example. You can use the following time lines. Please label clearly what is shown on each time line that you use.











Question 5 (14 points (2+2+2+2+6)):
Answer the following questions regarding safety and security in active networks.

a) SNAP achieves safety in terms of resource usage. Which resources are addressed by SNAP?

b) How does SNAP achieve bounds on usage for each of these resources?

c) What are the challenges of using cryptographic approaches in an active network?

d) How does the packet format proposed by Murphy et al. address these challenges?

e) Which of the following functions could or could not be implemented with SNAP? Explain why or why not.

a. Compute checksum over packet header.

b. Compute checksum over packet payload.

c. Compute checksum over entire packet.

d. Implement traceroute by adding each hop's address to the packet payload.

e. Implement multicast by duplicating packet.

f. Encrypt packet payload.

Question 6 (8 points (4+4)):
Answer the following questions regarding resource management in Darwin:

a) Darwin uses Xena, delegates, and hierarchical schedulers for resource management. Discuss these components and contrast their levels of operation.

b) In Darwin, a strong emphasis is put on hierarchical structuring. Why do the authors think this is important?

Question 7 (12 points (3+3+3+3)):
If you were working for a network service provider and your manager asked you to implement the new services below, how would you go about it (i.e., would you use an active network or a non-active solution)? Give some supporting arguments for your decision. (There is no right or wrong answer.)

a) Multicast.

b) Web caching.

c) Transcoding of web documents for mobile, wireless devices.

d) Blocking mechanism for peer-to-peer networks.