COMP9334 Revision Questions for Week 2

These questions are taken from Chapter 3 of Mensace et al. "Performance by Design".
The questions are Q 5, 6, 7 and 10 from Chapter 3. They have been reproduced below
for your convenience.

In addition, there are two questions on Poisson process.

5. A transaction processing system is monitored for one hour. During
   this period, 5,400 transactions are processed. What is the utilization
   of a disk if its average service time is equal to 30 msec per visit and
   the disk is visited three times on average by every transaction?

6. The average delay experienced by a packet when traversing a computer
   network is 100 msec. The average number of packets that cross the
   network per second is 128 packets/sec. What is the average number of
   concurrent packets in transit in the network at any time?

7. A file server is monitored for 60 minutes, during which time 7,200
   requests are completed. The disk utilization is measured to be 30%.
   The average service time at this disk is 30 msec per file operation
   request. What is the average number of accesses to this disk per file
   request?

10. An interactive system has 50 terminals and the user's think time is
    equal to 5 seconds. The utilization of one of the system's disk was
    measured to be 60%. The average service time at the disk is equal to
    30 msec. Each user interaction requires, on average, 4 I/Os on this
    disk. What is the average response time of the interactive system?

Questions on the arrival process.

Question 1. If the inter-arrival time of requests at a server is exponentially distributed with a mean rate of 20 requests per second, answer the following questions.
   a) What is the mean inter-arrival time?
   b) Over a duration of 1 minute, what is the mean number of requests arriving at the server?
   c) Over a duration of 1 minute, what is the probability of having no arrivals at the server?
   d) Over a duration of 1 minute, what is the probability of having 10 arrivals at the server?

Question 2. This question is about Poisson Process. A server receives requests from two arrival processes. Both arrival processes are Poisson. The rates of these two processes are r_1 and r_2 respectively. Assuming these two processes are independent, prove that the aggregation of these two arrival processes is also Poisson. What is the aggregated arrival rate?