STAT 201
Normal and Exponential RV Practice Problems

The text material for these topics can be found in Sections 7.1-7.3 and 7.5 (new edition) or Sections 6.3, 6.4, and 6.6 (old edition). The problems are based on problems from the new edition (I’m using their problem numbers), with modifications and additional parts in some cases.

7.21 Using the standard normal table, find the following probabilities associated with $z$.
(a) $P\{0.00 \leq z \leq 1.10\}$
(b) $P\{z \geq 1.10\}$
(c) $P\{z \leq 1.35\}$
(d) $P\{-1.26 < z < 1.74\}$

7.23 Using the standard normal table, find the following probabilities associated with $z$.
(a) $P\{-1.96 \leq z \leq 1.27\}$
(b) $P\{0.29 \leq z \leq 1.00\}$
(c) $P\{-2.87 \leq z \leq -1.22\}$

7.27 In 1998, the average conventional first mortgage for new single family homes was for $195,000. Assume that mortgage amounts are normally distributed with a standard deviation of $\sigma = 30,000$. Find the probability that a randomly selected mortgage amount is…
(a) between $140,000 and $160,000
(b) over $160,000
(c) under $225,000
(d) Find the 85th percentile mortgage amount (not in text)

7.31 Media researchers report the average daily TV viewing time for U.S. adult males to be 4.28 hours. Assuming a normal distribution with a standard deviation of 1.30 hours:
(a) What is the probability that a randomly selected U.S. adult male watches TV less than 2.00 hours per day?
(b) How much TV would a U.S. adult male have to watch per day in order to be at the 99th percentile?

7.49 The main switchboard at the Home Shopping Network receives calls from customers. If the Poisson distribution were applied to this process, what would the appropriate random variable? What would be the exponential distribution counterpart to this random variable?
7.51 The number of calls $X$ to a psychic hotline follows a Poisson distribution with a mean rate of $\lambda = 0.02$ calls per minute. Let $Y$ represent the time that passes between successive calls. Find:

My questions:
(1) $P\{\text{No calls in a five-minute period}\}$
(2) $P\{\text{At least two calls in a twenty minute period}\}$

Text questions:
(a) $P\{Y \geq 30 \text{ minutes}\}$
(b) $P\{Y \geq 40 \text{ minutes}\}$
(c) $P\{Y \geq 50 \text{ minutes}\}$
(d) $P(Y \geq 60 \text{ minutes})$

7.52 A taxi dispatcher has found that the time between successive calls for taxis is exponentially distributed with a mean time between calls of 5.30 minutes. The dispatcher much disconnect the telephone for 3 minutes in order to have the push-button mechanism repaired. What is the probability that a call will be received while the system is out of service? (You could assume that a call came in just before the system went out of service, although it actually doesn’t matter.)
Solutions:

7.21 (a) 0.3643 (b) 0.1357 (c) 0.9115 (d) 0.8553

7.23 (a) 0.8730 (b) 0.2272 (c) 0.1091

7.27 (a) 0.0874 (b) 0.8790 (c) 0.8413 (d) $226,200

7.31 (a) 0.0401 (b) 7.31 hours

7.49 Poisson: We’d be looking at \( x \) = the number of calls that come in during some time period of interest. Poisson RVs relate to the number of times some event of interest, in this case a call, occur during some time period. Exponential counterpart: We’d be interested in \( y \) = the time that passes between incoming calls. If the number of incoming calls follows a Poisson distribution, then the time between calls follows an exponential. (The point of this problem is simply to remind you what Poisson and exponential variables typically represent.)

7.51 (1) 0.9048 (2) 0.0616 (a) 0.5488 (b) 0.4493 (c) 0.3679 (d) 0.3012

7.52 0.4322