Homework 3

Discrete and Continuous Random Variables

Requirement

- Send soft copies (digital files) to the following email address: 25b358009@stu.hit.edu.cn

- Write your name and student number.

- Submit within a week! Late submission should have a reasonable explanation sent to the TA or lecturer in advance.

- You may discuss with others. Write homework by yourself.

1. Classify each of the following random variables as discrete or continuous:

a   x =the number of girls born to a couple who will have three children.

b   x =the number of defects found on an automobile at final inspection.

c   x = the weight (in ounces) of the sandwich meat placed on a submarine sandwich.

d   x = the number of incorrect lab procedures conducted at a hospital during a particular week.

e   x =the number of customers served during a given day at a drive-through window.

f   x = the time needed by a clerk to complete a task.

g   x =the temperature of a pizza oven at a particular time.

2. The following table summarizes investment outcomes and corresponding probabilities for a particular oil well:

a   Graph p(x); that is, graph the probability distribution of x.
b   Find the expected monetary outcome. Mark this value on your graph of part a. Then interpret this value.
c   Calculate the standard deviation of x.

x = the outcome in $	p(x)
−$40,000 (no oil)	.25
10,000 (some oil)	.7
70,000 (much oil)	.05

3. Suppose that x is a binomial random variable with $n = 5$, $p = .3$, and $q = .7$.

a Write the binomial formula for this situation and list the possible values of x.

b For each value of x, calculate $p(x)$, and graph the binomial distribution.

c Find $P(x = 3)$.

d Find $P(x \leq 3)$.

e Find $P(x < 3)$.

f Find $P(x \geq 4)$.

g Find $P(x > 2)$.

h Use the probabilities you computed in part b to calculate the mean, μ_x, the variance, σ_x^2, and the standard deviation, σ_x, of this binomial distribution. Show that the formulas for μ_x, σ_x^2, and σ_x given in this section give the same results.

i Calculate the interval $[\mu_x \pm 2\sigma_x]$. Use the probabilities of part b to find the probability that x will be in this interval.

4. What two properties must be satisfied by a continuous probability distribution (or probability curve)?

5. Suppose that the random variable x has a uniform distribution with $c = 2$ and $d = 8$.

a Write the formula for the probability curve of x, and write an interval that gives the possible values of x.

b Graph the probability curve of x.

c Find $P(3 \leq x \leq 5)$.

d Find $P(1.5 \leq x \leq 6.5)$.

e Calculate the mean μ_x, variance σ_x^2, and standard deviation σ_x.

f Calculate the interval $[\mu_x \pm 2\sigma_x]$. What is the probability that x will be in this interval?

6 Suppose that the random variable x is normally distributed with mean $\mu = 1,000$ and standard deviation $\sigma = 100$. Sketch and find each of the following probabilities:

a $P(1,000 \leq x \leq 1,200)$

b $P(x > 1,257)$

c $P(x < 1,035)$

d $P(857 \leq x \leq 1,183)$

e $P(x \leq 700)$

f $P(812 \leq x \leq 913)$

g $P(x > 891)$

h $P(1,050 \leq x \leq 1,250)$