MAT 1372 Stat w/ Prob classwk 18 Spring 2012

Sections 6.5 to 6.7 are somewhat antiquated as they focus on tables for many of the calculations. Nowadays it makes more sense to use a calculator or software such as Excel. However, we will continue to insist that you do the problems by converting to and from the standard situation. The pedagogical reason is that if we use Excel functions like NORMDIST, then there is not really much calculation to do and you miss out on the valuable grappling with the material that happens by forcing you to use the standard versions of the Excel functions, such as NORMSDIST. Also, you must draw pictures for each problem. Again the reason is to help solidify the topic in your minds.

* Section 6.5: we converted to Standard and then use **NORMSDIST** to find probabilities
* Section 6.6: some important **properties**
* Section 6.7: given probabilities, we use **NORMSINV** to find “zscores”, then “Un”standardize to find scores.

**6.6 PROPERTIES OF NORMAL RANDOM VARIABLES**

Recall:

* for random vars X and Y, *E*[*X* + *Y*] = *E*[*X*] + *E*[*Y*] = μ*x* + μ*y*
* for **INDEPENDENT** random vars X and Y:

Var(*X* + *Y*) = Var(*X*) + Var(*Y*) = 

Suppose *X* and *Y* are independent **normal** random variables with means μ*x* and

μ*y* and standard deviations σ*x* and σ*y* , respectively. Then *X* + *Y* has

mean: *E*[*X* + *Y*] = μ*x* + μ*y*

standard deviation: SD(*X* + *Y*) = 

and is **normal** (needs proof but we just accept as fact).

**6.7 PERCENTILES OF NORMAL RANDOM VARIABLES**

**(the inverse problem)**

The **zscore** *z*α is the value for which *P*{*Z* > *z*α} = α:

 The zscore is closely related to the percentile.

For example, if on a test, 75% of the scores were below 30, then 30 is the 75th percentile and 30 is the zscore for α=.25.

Think of a zscore as a **function** which inputs a probability 0<α<1 and outputs a real number.

**1.** Find to two decimal places:

**(a)** *z*0.07 =Normsinv(1­­­­­­­­­­­­­−0.07)

**(e)** *z*0.65=Normsinv(1­­­­­­­­­­­­­−0.65)

**(f)** *z*0.50

**(g)** *z*0.95

**2.** Find the value of *z* for which

**(a)** *P*{|*Z*| > *z*} = 0.05

 z=Normsinv(1−0.025)

Recall that. If we solve for x we get



Once a zscore is found, we use the above formula to “de”standardize.

**3.** If *X* is a normal random variable with μ=50 and σ=6,

find the approximate value of **x**for which

**(d)** *P*{*X* < **x**} = 0.05 **x** =6\*Normsinv(0.05)+50

**(e)** *P*{*X* < **x** } = 0.88

 **(a)** *P*{*X* > **x** } = 0.5

**(b)** *P*{*X* > **x** } = 0.10 **x** =6\*Normsinv(1­−0.1)+50

**(c)** *P*{*X* > **x** } = 0.025

(f) *P*{|*X*−50| > **x** } = 0.05

(g) *P*{|*X*−50| < **x** } = 0.65

**6.** The time it takes for junior high girls to run 1 mile is normally distributed

with mean 460 seconds and standard deviation 40 seconds.

As a selection mechanism, the track team will only take girls that run in the top 20%. What is the critical time below which the girl must reach to make the team?

*P*{*X* < **x**} = 0.2 **x** =40\*Normsinv(0.2)+460=426 seconds or 7 min 6 sec.

**9.** The amount of radiation that can be absorbed by an individual before

death ensues varies from individual to individual. However, over the

entire population this amount is normally distributed with mean 500

roentgens and standard deviation 150 roentgens. Above what dosage

level will only 5 percent of those exposed survive?

Answer: 747

Apparently, these numbers were gathered from the Chernobyl accident. The roentgen is also known as rem. Since then, the unit used for radiation absorption has been changed to the sievert (1sievert = 100 rems). See a recent [NYTimes graph](http://www.nytimes.com/interactive/2011/03/26/world/asia/dangers-of-radiation-for-workers-at-fukushima-daiichi.html?ref=asia)  for a comparison of the exposure that the Fukushima workers were receiving with that from Chernobyl:

1. **Dangers of Radiation for Workers at Fukushima Daiichi**

Inside the buildings of the damaged reactors at Fukushima Daiichi, workers attempting to make repairs are facing dangerous risks from radiation exposure. The burns suffered by two workers on Friday are just one indication of the perilous levels that likely exist in a number of areas in the plant. In these conditions, rapid exposure — in minutes to a few hours — to lethal doses is possible.

