Ithaca, NY is located in upstate New York and averages around 37" of rain each year, with standard deviation of 3.25". Rainfall in Ithaca, NY tends to follow an approximately normal distribution. Say that a student attends Cornell University in Ithaca and is there for 4 years.

$$z = \frac{\bar{X} - \mu}{se}$$

(a) Define the Central Limit Theorem: The sampling distribution of the sample mean is approximately normal with mean $\mu$ and standard error $se = \frac{\sigma}{\sqrt{n}}$, provided $n$ is sufficiently large. Since the distribution of rain is already normal, the sample size requirement is not necessary, so a sample size $n = 4$ is just fine

(b) Describe the sampling distribution of the sample mean of rainfall in Ithaca, NY. Include the mean of the sampling distribution of the sample mean and the standard deviation of the sampling distribution of the sample mean (standard error).

$$\bar{X} \sim N\left(\mu = 37, se = \frac{\sigma}{\sqrt{n}} = \frac{3.25}{\sqrt{4}} = 1.625\right)$$

Mean is 37, se is 1.625 and distribution is normal

(c) What is the probability that during the 4 years, we see an average less than 32"?

$$P(\bar{X} < 32) = P\left(Z < \frac{32 - 37}{1.625}\right) = P(Z < -3.08) = 0.001 = 0.1\%$$

Statdistributions.com: z=-3.08, LT: http://www.statdistributions.com/normal?z=-3.08&tail=3

(d) What are the wettest 7% of years?
Find z for top 7%: statdistrbutions.com: p-value=.07, RT:
http://www.statdistributions.com/normal?p=0.07&tail=2

$z = \frac{\bar{X}-\mu}{se}$ ➔ solve for x-bar: $\bar{X} = z(se) + \mu$ ==> $\bar{X} = (1.476)(1.625) + 37 = 39.4$" of rain

Ithaca, NY is located in upstate New York and averages around 37" of rain each year, with standard deviation of 3.25". Rainfall in Ithaca, NY tends to follow an approximately normal distribution. Say that a student attends Cornell University in Ithaca and is there for 7 years (undergraduate and graduate degrees).

$$\mu = 37, \sigma = 3.25, n = 7$$

Total: $\tau = n\mu = 7(37) = 259$ and standard error: $se = \sqrt{n}\sigma = \sqrt{7}(3.25) = 8.6$

$$z = \frac{\hat{t} - \tau}{se}$$

(a) Describe the sampling distribution of the total rainfall in Ithaca, NY. Include the total of the sampling distribution and the standard deviation of the sampling distribution of the total (standard error)

$$\hat{t} \sim N(259, 8.6)$$

mean of sampling distribution of total is 259 with se 8.6 and distribution is normal

(b) What is the probability that during the 7 years, we see a total precipitation of less than 220"?

$$P(\hat{\tau} < 220) = P\left(Z < \frac{220 - 259}{8.6}\right) = P(Z < -4.53) = 0$$

Statdistributions.com: z=-4.53, LT: http://www.statdistributions.com/normal?z=-4.53&tail=3

(c) What is the 90th percentile for total precipitation? Statdistributions.com: p-value=.9, LT: http://www.statdistributions.com/normal?p=0.9&tail=3 $z = 1.282$

$z = \frac{\hat{\tau}-\tau}{se}$ ➔ solve for tau-hat: $\hat{\tau} = z(se) + \tau ==> \ \hat{\tau} = (1.282)(8.6) + 259 = 270''$

A survey of purchasing agents from 250 randomly selected industrial companies found that 25% of the buyers reported higher levels of new orders in January than in earlier months.

$$n = 250, \pi = 0.25$$

$$\hat{\pi} \sim N\left(\pi, se = \sqrt{\frac{\pi(1-\pi)}{n}}\right)$$

$$z = \frac{\hat{\pi} - \pi}{se}$$

(a) Describe the sampling distribution of the proportion of buyers in the US with higher levels of new orders in January. Include the mean of the sampling distribution and the standard deviation of the sampling distribution (standard error).

Mean is $\pi = 0.25$, the $se = \sqrt{\frac{\pi(1-\pi)}{n}} = \sqrt{\frac{0.25(1-0.25)}{250}} = 0.0274$; distribution is normal

$$\hat{\pi} \sim N(0.25, 0.0274)$$

(b) What is the probability that the sample proportion is more than 26%?

$$P(\hat{\pi} > 0.26) = P\left(Z > \frac{0.26 - 0.25}{0.0274}\right) = P(Z > 0.36) = 0.359 = 35.9\%$$

statdistirbutions.com: z=.36, RT http://www.statdistributions.com/normal?z=0.36&tail=2

(c) What is the probability that the sample proportion is less than 20%?

$$P(\hat{\pi} < 0.2) = P\left(Z < \frac{0.2 - 0.25}{0.0274}\right) = P(Z < -1.82) = 0.034 = 3.4\%$$

Statdistributions.com: z=-1.82, LT: http://www.statdistributions.com/normal?z=-1.82&tail=3