CH 4.3

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10/31/2018

MATH 324 Ch 4.3

Standard Normal R Calculations

1A) P(0 < Z < 2.17)?

```
pnorm(2.17) - pnorm(0)
```

```
## [1] 0.4849966
```

1B) P(-2.5 <= Z <= 0)?

```
pnorm(0) - pnorm(-2.5)
```

```
## [1] 0.4937903
```

1C) P(-2.5 <= Z <= 2.5)?

```
pnorm(2.5)-pnorm(-2.5)
```

```
## [1] 0.9875807
```

1D) P(Z <= 1.37)?

```
pnorm(1.37)
```

```
## [1] 0.9146565
```

1E) P(Z >= -1.75)?

```
1-pnorm(-1.75)
```

```
## [1] 0.9599408
```

1G) P(-1.5 <= Z <= 2)?

```
pnorm(2)-pnorm(-1.5)
```

```
## [1] 0.9104427
```

1H) P(1.37 <= Z <= 2.5)?

```r
pnorm(2.5)-pnorm(1.37)
```

```
## [1] 0.07913379
```

1I) P(Z >= 1.5)?

```r
1-pnorm(1.5)
```

```
## [1] 0.0668072
```

1J) P(|Z| <= 2.50) = P(-2.50 <= Z <= 2.50)

```r
pnorm(2.5)-pnorm(-2.5)
```

```
## [1] 0.9875807
```

Percentiles of Z

2A) n(91)

phi(z) = 0.91 = c = 1.34

2B) n(9)

phi(z) = 0.09 = -0.91 = -1.34

2C) n(75)

phi(z) = 0.75 = c =.675

2D) n(25)

phi(z) = 0.25 = -0.75 = -0.675

2E) n(6)

phi(z) = 0.06 = c = -0.1555

3A) phi(c) = 0.9838 (98.38th percentile)

found in 2.1 row and the 0.04 column so standard table = c = 2.14

3B) P(0 <= Z <= c)= 0.291

phi(c) = 0.7910 = c =0.81

3C) 1 - phi(c)=P(Z >= c)=.121

1 - P(c <= Z) = P(Z < c) = phi(c)= 1 - 0.121 = 0.8790 = c = 1.17

3D) P(-c <= Z <= c)= 0.668

P(-c<= Z <= c)= phi(c)- pho(-c) = phi(c) – (1 - phi(c)) = 2 * phi(c) – 1 = phi(c)= 0.9920 = c = 0.97

3E) P(|Z| >= c)=.016

1 - 0.016 = 0.9840 = 1–P(c <= |Z|) = P(|Z| < c) = P(-c < Z < c) = phi(c) - phi(-c) = 2 * phi(c) – 1 = phi(c) = 0.9920 = c = 2.41

4A) alpha = 0.0055 (99.45th percentile)

```r
qnorm(0.055)
```

```
## [1] -1.598193
```

4B) alpha = 0.09 (100(1-.09)th percentile)

```r
qnorm(0.09)
```

```
## [1] -1.340755
```

4C) alpha = 0.663 (100(1-.66)th percentile)

```r
qnorm(0.663)
```

```
## [1] 0.4206646
```

Word Problems for X ~ N(Mu, sigma ^ 2)

In a road-paving process, asphalt mix is transfered by truck. Let X = truck haul time be normally distributed with mean 8.46 min and standard deviation .913 min.

5A)

What is the probability that haul time will be at least 10 minutes?

P(X >= 10) = P((X - Mu/sigma) >= 10-8.46/0.913) P(Z >= 1.69) P(Z <= -1.69)

```r
pnorm(-1.69)
```

```
## [1] 0.04551398
```

5B)

What is the probability that haul time will exceed 10 minutes?

P(X > 10) = P(X >= 10) = 0.0455

5C)

What is the probability that haul time will be between 8 and 10 minutes?

P(8 <= X <= 10) = P((8-8.46/0.913) <= (X - Mu/sigma) <= (10-8.46/0.913)) = P(-0.5 <= Z <= 1.69) = P(Z <= 1.69) - P(Z <= -0.5)

```r
pnorm(1.69) - pnorm(-0.5)
```

```
## [1] 0.6459485
```

5D)

What value c is such that 98% of all haul times are in the interval from 8.46 - c to 8.46 + c.

P(8.46 - c <= X <= 8.46 + c) = 0.98 P(-c <= X -8.46 <= c) = 0.98 P(-c <= X - Mu <= c) = 0.98 P((-c/0.913) <= (X - Mu/sigma) <= (c/0.9.13) = 0.98 P((-c/0.913 <= Z <= (c/0.913)) = 0.98 2P (Z <= c/0.913) - 1 = 0.98 P(Z <= c/0.913) = 1+0.98/2 P(Z <= c/0.913) = 0.99 c/0.913 = 2.33 c = 2.33 * 0.913 c = 2.127

5E)

If four haul times are independently selected, what is the probability that at least one of them exceeds 10 minutes?

P(X > 10) = 0.0455 P(at least on exceeds) = 1 - P(none of the four exceeds) = 1 - P(X<10)^4 = 1 - [1 - P(X > 10)]^4 = 1 - [1 - 0.0455]^4 = 0.169951