Homework 01 Answer Sheet

Psych 10C

Due: Sunday, October 2nd (by 11:59pm PT)

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Submission Details

- Download *HW01AnswerSheet.Rmd* from the Canvas course space and open it RStudio.
- Enter your name in the *author* field at the top of the document.
- Complete the assignment by entering your answers in your *HW01AnswerSheet.Rmd* document.
- Once you have completed the assignment, click the *Knit* button to turn your completed answer document into a pdf file.
- Submit your HW01AnswerSheet.pdf file only (no other formats are acceptable) before the assignment's deadline.

Problems

For each problem, show the RStudio code needed to solve each problem and verify your answer using the standard normal distribution table supplied on the course website. Show/describe all of your work.

Problem #1 (5 points)

For a normal distribution, find the probability that a sampled score is:

(a) higher than two standard deviations *above* the mean

ANSWER (RStudio Code):

```
pnorm(2, lower.tail = FALSE)
```

```
## [1] 0.02275013
```

ANSWER (Confirmation from standard normal distribution table):

- P(Z > +2.00) = 0.0228(From the table)

(b) lower than two standard deviations *below* the mean

ANSWER (RStudio Code):

```
# P(Z < -2.00)= P(Z > +2.00)
pnorm(2, lower.tail= FALSE)
```

```
## [1] 0.02275013
```

ANSWER (Confirmation from standard normal distribution table):

- $P(Z > +2.00) = 0.0228$ (From the table)

(c) higher than 1.67 standard deviations *above* the mean

ANSWER (RStudio Code):

```
pnorm(1.67, lower.tail = FALSE)
```

```
## [1] 0.04745968
```

ANSWER (Confirmation from standard normal distribution table):

- P (Z> 1.67)= 0.0475 (From the table)

(d) lower than 0.85 standard deviations *below* the mean

ANSWER (RStudio Code):

```
# P (Z< -0.85) = P(Z> 0.85)
pnorm(0.85, lower.tail = FALSE)
```

```
## [1] 0.1976625
```

ANSWER (Confirmation from standard normal distribution table):

- P(Z>0.85) = 0.1977

(e) higher than 1.33 standard deviations *below* the mean

ANSWER (RStudio code):

```
pnorm(1.33)
```

```
## [1] 0.9082409
```

ANSWER (Confirmation from standard normal distribution table):

- P(z>-1.33)= P(z<1.33)= 1-P(z>1.33)= 1-0.0918=0.9082

Problem #2 (4 points)

Find the z-score for which the probability that a normal variable exceeds that score equals:

(a) 0.3300

ANSWER (RStudio code):

```
qnorm(0.3300, lower.tail = FALSE)
```

```
## [1] 0.4399132
```

ANSWER (Confirmation from standard normal distribution table):

- 0.44 from the table

(b) 0.3015

ANSWER (RStudio code):

```
qnorm(0.3015, lower.tail = FALSE)
```

```
## [1] 0.5200912
```

ANSWER (Confirmation from standard normal distribution table):

- 0.52 from the table

(c) 0.0436

ANSWER (RStudio code):

```
qnorm(0.0436, lower.tail = FALSE)
```

```
## [1] 1.710356
```

ANSWER (Confirmation from standard normal distribution table):

- 1.71 from the table

(d) 0.0495

ANSWER (RStudio code):

```
qnorm(0.0495, lower.tail = FALSE)
```

```
## [1] 1.649721
```

ANSWER (Confirmation from standard normal distribution table):

- 1.65 from the table.

Problem #3 (4 points)

At Jefferson High School, SAT verbal scores have approximately a normal distribution with a mean of 500 and a standard deviation of 100.

(a) What proportion of the students has SAT verbal scores that are at least 600?

ANSWER (RStudio code):

```
(z<- (600-500)/100)
```

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

```r
(pnorm(z, lower.tail = FALSE))
```

```
## [1] 0.1586553
```

ANSWER (Confirmation from standard normal distribution table):

- From the table, P(z>1)= 0.1587

(b) What proportion of the students has SAT verbal scores that are at least 400?

ANSWER (RStudio code):

```r
(z<-(400-500)/100)
```

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

```r
(pnorm(-z))
```

```
## [1] 0.8413447
```

ANSWER (Confirmation from standard normal distribution table):

- P(z>-1)= P(z<1)= 1-P(z>1)= 1-0.1587= 0.8413

(c) What proportion of the students has SAT verbal scores that are lower than 350?

ANSWER (RStudio code):

```r
(z<-(350-500)/100)
```

```
## [1] -1.5
```

```r
pnorm(-z, lower.tail = FALSE)
```

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

ANSWER (Confirmation from standard normal distribution table):

- P(z<-1.5)= P(z>1.5)=0.0668 from the table.

(d) Find an SAT verbal score such that only 10 percent of the students have scores above that value.

ANSWER (RStudio code):

```
(CValue<- qnorm(0.1, lower.tail = FALSE))
```

```
## [1] 1.281552
```

```
(SAT<-(CValue*100+500))
```

```
## [1] 628.1552
```

ANSWER (Confirmation from standard normal distribution table):

- When Z= 1.28, the proportion is close to 10% (from the table). From the equation raw score = Z-score * sd + mean, we know that SAT verbal score should be 1.28*100+500=628

Problem #4 (3 points)

Carter County Jail has a mean monthly inmate population of 20,000 with a standard deviation of 500. If the inmate population (considered on a monthly basis) is normally distributed.

(a) What is the probability of there being more than 21,800 inmates?

ANSWER (RStudio code):

```
(z<- (21800-20000)/500)
```

```
## [1] 3.6
```

```
(pnorm(z, lower.tail = FALSE))
```

```
## [1] 0.0001591086
```

ANSWER (Confirmation from standard normal distribution table):

- P(Z>3.6)= 0.0002 from the table.

(b) What is the probability of there being fewer than 18,800 inmates?

ANSWER (RStudio code):

```
(z<- (18800-20000)/500)
```

```
## [1] -2.4
```

```
(pnorm(z))
```

```
## [1] 0.008197536
```

ANSWER (Confirmation from standard normal distribution table):

- P(z<-2.4)=P(z>+2.4)= 0.0082 from the table.

(c) What is the probability of there being between 19,000 and 21,000 inmates in a given month?

ANSWER (RStudio code):

```
#one way to solve this problem
(PHigh<- pnorm(21000, 20000, 500))
```

```
## [1] 0.9772499
```

```
(PLow<- pnorm(19000, 20000, 500))
```

```
## [1] 0.02275013
```

```
(PBetween<- PHigh-PLow)
```

```
## [1] 0.9544997
```

```
# another way to solve it
(HighTail<- 1-pnorm(21000, 20000, 500))
```

```
## [1] 0.02275013
```

```
(LowTail<- pnorm(19000,20000, 500))
```

```
## [1] 0.02275013
```

```r
(PBetween<- 1-HighTail-LowTail)
```

```
## [1] 0.9544997
```

ANSWER (Confirmation from standard normal distribution table):

- The probability between 19000 and 21000 is the area under the curve that excludes the area x<19000 and x>21000. From the table, we know that P(Z<-2)=P(Z>2)=0.0228. P(19000<X<21000) = 1-0.0228-0.0228 = 0.9544

Problem #5 (5 points)

A recently admitted class of graduate students at a large state university has a mean Graduate Record Exam verbal score of 650 with a standard deviation of 50. (The scores are reasonably normally distributed.) One of the students, who just happens to have a mother on the board of trustees, was admitted with a GRE score of 490. Should the local newspaper editor, who loves scandals, write a scathing editorial (i.e. is being admitted with a score of 490 an unusual occurrence)?

ANSWER (RStudio code):

```r
(z<- (490-650)/50)
```

```
## [1] -3.2
```

```r
(Prob<- pnorm(z))
```

```
## [1] 0.0006871379
```

- Yes, local newspaper editor SHOULD write a scathing editorial. Suppose our null hypothesis is "being admitted with a score of 490 is not an unusual occurrence." After calculation, we got 0.000687, which means if we randomly selected a person who was admitted, the probability for that person with a score equal or lower than 490 is 0.000687. Since 0.000687<0.05, we reject the null hypothesis and admit that being admitted with a score of 490 is an unusual occurrence.

ANSWER (Confirmation from standard normal distribution table):

- P(Z<-3.2)= P(Z>3.2)= 0.0007 from the table. 0.0007<0.05, therefore the aditor should write a scathing editorial.
