Practice 9 answers in R:

Question 1:

```
> #1 Two proportions:
>#prop.test(x=c(x1,x2), n=c(n1,n2), alternative="*", correct=F, conf.level= )
# alternatives are; "two.sided", "less", "greater"
> # Ho: P1=P2   H1: P1 > P2  alpha = 0.01
> prop.test(x=c(38,23), n=c(85,90), alternative="greater", correct=F) # conf.
level not needed in this case

2-sample test for equality of proportions without continuity correction

data:  c(38, 23) out of c(85, 90)
X-squared = 7.0602, df = 1, p-value = 0.003941
alternative hypothesis: greater
95 percent confidence interval:
 0.07493829 1.00000000
sample estimates:
   prop 1    prop 2
0.4470588 0.2555556

> # Test Stat z=2.66 pvalue=0.0039 < alpha (0.01) Reject Ho.
> # Conclusions: There is sufficient evidence to support the claim that p1>p2
```

Question 2:

```
> # Ho: P1=P2   H1: P1 != P2  alpha = 0.05,  x1=31, x2=22, n1=1000, n2=1200
> prop.test(x=c(31,22), n=c(1000,1200), alternative="two.sided", correct=F)

2-sample test for equality of proportions without continuity correction

data:  c(31, 22) out of c(1000, 1200)
X-squared = 3.7224, df = 1, p-value = 0.05369
alternative hypothesis: two.sided
95 percent confidence interval:
 -0.0004865296  0.0258198629
sample estimates:
    prop 1     prop 2
0.03100000 0.01833333

> z=sqrt(3.7224) # test stat is given as x-squared. In our book/HW/Exams
questions, Z is required. z=sqrt(X-Squared)
> z
[1] 1.929352
> # Test Stat z=1.93  pvalue=0.0567 > 0.05  Fail to Reject
> #Conclusions: There is not sufficient evidence to warrant rejection of the
claim that the two proportions are equal.
```

Question 3:

```
> # two means t test:
> install.packages("BSDA")
> require(BSDA)
> #tsum.test(mean1,s1,n1,mean2,s2,n2,alt="**",conf.level=.95)
> tsum.test(19.4, 1.4, 35, 15.1, 0.8, 40, alt="two.sided")

        Welch Modified Two-Sample t-Test

data:  Summarized x and y
t = 16.025, df = 52.47, p-value < 2.2e-16
alternative hypothesis: true difference in means is not equal to 0
95 percent confidence interval:
 3.761675 4.838325
sample estimates:
mean of x mean of y
     19.4      15.1
 > # Test Stat t=16.025, pvalue=0 (it is 2.2 x 10^-16 which is apprx zero), alpha0.05
 > #Conclusions: There is sufficient evidence to warrant rejection of the claim that
  the two samples are from populations with the same mean.
```

Question 4:

```
> #Ho: mu1=mu2   H1: mu1 < mu2    alpha=0.05
> tsum.test(12.1,3.9,14,14.2,5.2,17, alt="less")

        Welch Modified Two-Sample t-Test

data:  Summarized x and y
t = -1.2835, df = 28.79, p-value = 0.1048
alternative hypothesis: true difference in means is less than 0
95 percent confidence interval:
        NA 0.6807102
sample estimates:
mean of x mean of y
     12.1      14.2


> # Test statistics: t=-1.283   pvalue=0.2096 > alpha (0.05)  Fail to Reject
Ho
> # Conclusions: There is not sufficient evidence to support the claim that
the mean amount of time spent watching television by women is smaller than
the mean amount of time spent watching television by men.
```

Question 5:

```
> # Ho: mu1=mu2   H1: mu1 < mu2    alpha=0.01
> tsum.test(120.5,17.4,101,149.3,30.2,105, alt="less")

        Welch Modified Two-Sample t-Test

data:  Summarized x and y
t = -8.4256, df = 167.43, p-value = 7.841e-15
alternative hypothesis: true difference in means is less than 0
95 percent confidence interval:
        NA -23.14637
sample estimates:
mean of x mean of y
    120.5     149.3

> # Test statistics: t=-8.426  pvalue=0.0 < alpha (0.01)   Reject Ho
> #There is sufficient evidence to support the claim that the treatment group
is from a population with a smaller mean than the control group
```

Question 6:

```
> # Ho: mu1=mu2, H1: mu1 < mu2,  alpha=0.05
> Female<-c(495,760,556,904,52,1005,743,660)
> Male<-c(722,562,880,520,500,1250,750,1640,518,904,1150,805,480,970,605)
> t.test(Female, Male, mu=0, alternative = "less")

        Welch Two Sample t-test

data:  Female and Male
t = -1.2681, df = 16.008, p-value = 0.1114
alternative hypothesis: true difference in means is less than 0
95 percent confidence interval:
     -Inf 64.11718
sample estimates:
mean of x mean of y
 646.8750  817.0667
> # test stat: t = -1.268, pvalue = 0.1114   pvalue > alpha (0.05)  Fail to
Reject Ho
> # Conclusions: There is not sufficient evidence to support the claim that t
he mean salary of female employees is less than the mean salary of male emplo
yees
```

Next four questions: confidence intervals for the difference of two means. **Important:**
1. Use the tsum.test function, this time we need to specify confidence level.
2. Interpretation: The confidence interval generated allows to draw a conclusion about whether or not there is a difference between the two populations means. There are three cases:
 a. Both sides of the Confidence interval are positives: It implies that mea1 > mean 2.
 b. Both sides of the Confidence interval are negatives: It implies that mea1 < mean 2.
 c. Left side is negative and right side is positive. It is said that the interval *contains zero*; that is, that the difference of means includes the value zero, which implies that there is no difference between the two population means.

Question 7:

```
> #tsum.test(mean1,s1,n1,mean2,s2,n2,alt="**",conf.level=.95)
> tsum.test(19.4, 1.4, 35, 15.1, 0.8, 40, alt="two.sided", conf.level=0.95)

        Welch Modified Two-Sample t-Test

data:  Summarized x and y
t = 16.025, df = 52.47, p-value < 2.2e-16
alternative hypothesis: true difference in means is not equal to 0
95 percent confidence interval:
 3.761675 4.838325
sample estimates:
mean of x mean of y
     19.4      15.1


> # Answer: 3.76 < mu1-mu2 < 4.83 Both sides of the interval are positives or
greater than zero; it implies that population 1 mean is > population mean 2.
```

Question 8:

```
> tsum.test(677, 30, 245, 211, 30,245, alt="two.sided", conf.level=0.80)

        Welch Modified Two-Sample t-Test

data:  Summarized x and y
t = 171.92, df = 488, p-value < 2.2e-16
alternative hypothesis: true difference in means is not equal to 0
80 percent confidence interval:
 462.5216 469.4784
sample estimates:
mean of x mean of y
      677       211


># Answer: 462.52 < mu1-mu2 < 469.47 Both sides of the interval are positives
or greater than zero; it implies that population 1 mean is > population mean
2.
```

Question 9:

```
> tsum.test(12.8, 3.9, 14, 14.0, 5.2,17, alt="two.sided", conf.level=0.99)

        Welch Modified Two-Sample t-Test

data:  Summarized x and y
t = -0.73342, df = 28.79, p-value = 0.4692
alternative hypothesis: true difference in means is not equal to 0
99 percent confidence interval:
 -5.712176  3.312176
sample estimates:
mean of x mean of y
     12.8      14.0


> # Answer: -5.71 < mu1-mu2 < 3.31 Left side of the interval is negative or
less than zero; right side is positive, or greater than zero. It is said that
the interval contains zero; therefore,  it implies that that there is no
difference between the two population means.
```

Question 10:

```
> Country.A<-c(64.1,66.4,61.7,62.0,67.3,64.9,64.7,68.0,63.6)
> Country.B<-c(65.3,60.2,61.7,65.8,61.0,64.6,60.0,65.4,59.0)
> t.test(Country.A, Country.B, mu=0, conf.level = 0.90)

        Welch Two Sample t-test

data:  Country.A and Country.B
t = 1.8895, df = 15.356, p-value = 0.07786
alternative hypothesis: true difference in means is not equal to 0
90 percent confidence interval:
 0.161159 4.216619
sample estimates:
mean of x mean of y
 64.74444  62.55556



> # Answer: 0.16 < mu1-mu2 < 4.22 Both sides of the interval are positives or
greater than zero; it implies that population 1 mean is > population mean 2.
```