I. Article (available through ILLIAD interlibrary loan)
   b. Cross-sectional data is inherently limited for detection of mediation. The mediator must fall temporally between the treatment and outcome.
   c. Like all statistical reporting, sufficient detail should be provided to allow future meta-analysis. For multiple testing, a Bonferroni correction should be applied.
   d. With more than trivial amounts of missing data, multiple imputation should be used. If the data are not missing at random (given the covariates), the results will be unbiased. Although some sensitivity testing is possible, testing for MAR is not possible.
   e. Power analysis is important, and usually requires simulation (future class)

II. HW1 (mediationHW1Sol.R)
   a. Simulation
      
      ```
      n = 400
      bxm = 1.5
      bmy = 2
      bdirect = 0.5
      cat("b indirect =", bxm*bmy, "  b direct =", bdirect, ", \n")
      z = rnorm(n)
      x = rnorm(n, 1 + x - 0.9*z, 0.5)
      m = rnorm(n, 5 + bxm*x - 0.8*z, 1.5)
      y = rnorm(n, 20 + bdirect*x + bmy*m, 0.8)
      dtf = data.frame(x, m, y, z)
      write.csv(dtf, "dtf.csv", row.names=FALSE, quote=FALSE)
      
      b. Ignoring confounder
      library("mediation")
      mxm = lm(m ~ x, data=dtf)
      mxmy = lm(y ~ x + m, data=dtf)
      m1 = mediate(mxm, mxmy, treat="x", mediator="m")
      print(summary(m1))
      plot(m1)
      ```
Causal Mediation Analysis
Quasi-Bayesian Confidence Intervals

<table>
<thead>
<tr>
<th></th>
<th>Estimate</th>
<th>95% CI Lower</th>
<th>95% CI Upper</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACME</td>
<td>3.978</td>
<td>3.696</td>
<td>4.27</td>
<td>&lt;2e-16 ***</td>
</tr>
<tr>
<td>ADE</td>
<td>0.507</td>
<td>0.387</td>
<td>0.63</td>
<td>&lt;2e-16 ***</td>
</tr>
<tr>
<td>Total Effect</td>
<td>4.485</td>
<td>4.216</td>
<td>4.75</td>
<td>&lt;2e-16 ***</td>
</tr>
<tr>
<td>Prop. Mediated</td>
<td>0.887</td>
<td>0.859</td>
<td>0.91</td>
<td>&lt;2e-16 ***</td>
</tr>
</tbody>
</table>

Sample Size Used: 400  Simulations: 1000

c. Including common cause

```r
mxzm = lm(m ~ x + z, data=dtf)
m2 = mediate(mxzm, mxmy, treat="x", mediator="m")
print(summary(m2))
plot(m2)
```

<table>
<thead>
<tr>
<th></th>
<th>Estimate</th>
<th>95% CI Lower</th>
<th>95% CI Upper</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
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</tr>
<tr>
<td>Total Effect</td>
<td>3.546</td>
<td>3.169</td>
<td>3.96</td>
<td>&lt;2e-16 ***</td>
</tr>
<tr>
<td>Prop. Mediated</td>
<td>0.857</td>
<td>0.820</td>
<td>0.89</td>
<td>&lt;2e-16 ***</td>
</tr>
</tbody>
</table>

Sample Size Used: 400  Simulations: 1000

```r
plot(m2)
```