Stat 204   *Exam 3a*   *Name:*

All statements should be expressed in complete sentences, and every numerical answer should be justified by showing how it was obtained. Writing R code that will actually calculate the numerical answer is definitely encouraged, followed by displaying the numerical answer your code returns. Recall that the point of this exam is to demonstrate your mastery of complete analytic processes.

I pledge that I have neither given nor received unauthorized aid on this exam. Pledged: . . . .

dust exposure for tunnel construction workers

> *Exposure to dust at work can lead to lung disease later in life. One study measured the workplace exposure of tunnel construction workers. Part of the study compared 115 drill and blast workers with 220 outdoor concrete workers. Total dust exposure was measured in millegram years per cubic meter ($mg.y/m^3$). The mean exposure for the drill and blast workers was 18 $mg.y/m^3$ with a standard deviation of 7.8 $mg.y/m^3$. For the outdoor concrete workers, the corresponding values were 6.5 $mg.y/m^3$ and 3.4 $mg.y/m^3$.* [1]

[1] Moore, et al., 2014, Exploring the Practice of Statistics, Freeman, ex. 7.53, p.411

95% CI

> *Calculate a 95% confidence interval to describe the difference in the exposures. Interpret the result in context.*

For a CI for a difference of two means (independent samples):

- [1 point] Define $\mu_1, \bar{x}_1, s_1, n_1, \mu_2, \bar{x}_2, s_2, n_2$

- State α

$\alpha = 0.05$

- Calculate $\bar{x}_1, s_1, n_1, \bar{x}_2, s_2, n_2, \alpha$

```
x1.bar <- 18.0   # drill and blast workers
s1 <- 7.8
n1 <- 115
x2.bar <- 6.5    # outdoor concrete workers
s2 <- 3.4
n2 <- 220
alpha <- 0.05
```

Welch-Satterthwaite formula for df

```
t.df <- function(s1, n1, s2, n2){
  v1 <- s1^2 / n1
  v2 <- s2^2 / n2
  numer <- (v1 + v2)^2
  denom <- v1^2 / (n1 - 1) + v2^2 / (n2 - 1)
  df <- floor(numer / denom)
  return(df)
}
```

- [5 points] Calculate $point.estimate, df, t^*, SE, CI$

```
#  point.estimate



#  df



#  t.star



#  se



#  ci



#
```

[1 point]

- Sketch the CI

- State the conclusion in context. Mention the level of confidence.

HT

> *Test the null hypothesis that the exposures for these two types of workers are the same.*

For an HT for a difference of two means (independent samples):

- State H_0, H_a and α

$H_0 : \mu_1 - \mu_2 = 0$
$H_a : \mu_1 - \mu_2 \neq 0$

$\alpha = 0.05$

- [2 points] Calculate the test statistic t, and the P-value $p.value$

```
#  t




#  p.value




#
```

[1 point]

- On a sketch of the appropriate t distribution, locate t and shade the region whose area is $p.value$

- State the formal conclusion of the HT and explain how you reached that conclusion

- State the conclusion in context. Mention the level of confidence. Include a succinct report of the form $(t =, df =, p.value =)$.