# Midterm Review

**Questions**

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Solutions

Posted!!

Help

Use Ed or office hours for getting help with these practice questions - avoid emails!

In 2020, employees of Blizzard Entertainment circulated a spreadsheet to anonymously share salaries and recent pay increases amidst rising tension in the video game industry over wage disparities and executive compensation. (Source: Blizzard Workers Share Salaries in Revolt Over Pay)

The name of the data frame used for this analysis is `blizzard_salary` and the variables are:

- `percent_incr`: Raise given in July 2020, as percent increase with values ranging from 1 (1% increase to 21.5 (21.5% increase)
- `salary_type`: Type of salary, with levels `Hourly` and `Salaried`
- `annual_salary`: Annual salary, in USD, with values ranging from $50,939 to $216,856.
- `performance_rating`: Most recent review performance rating, with levels `Poor`, `Successful`, `High`, and `Top`. The `Poor` level is the lowest rating and the `Top` level is the highest rating.

The top ten rows of `blizzard_salary` are shown below:

```
# A tibble: 409 x 4
   percent_incr salary_type annual_salary performance_rating
          <dbl> <chr>               <dbl> <chr>
 1          1   Salaried              1  High
 2          1   Salaried              1  Successful
 3          1   Salaried              1  High
 4          1   Hourly            33987. Successful
 5         NA   Hourly            34798. High
 6         NA   Hourly            35360  <NA>
 7         NA   Hourly            37440  <NA>
 8          0   Hourly            37814. <NA>
 9          4   Hourly            41101. Top
10          1.2 Hourly            42328  <NA>
# i 399 more rows
```

## Question 1

Which of the following is **correct**? Choose all that apply.

a. The `blizzard_salary` dataset has 399 rows.

b. The `blizzard_salary` dataset has 4 columns.

c. Each row represents a Blizzard Entertainment worker who filled out the spreadsheet.

d. The `percent_incr` variable is an integer numerical variable.

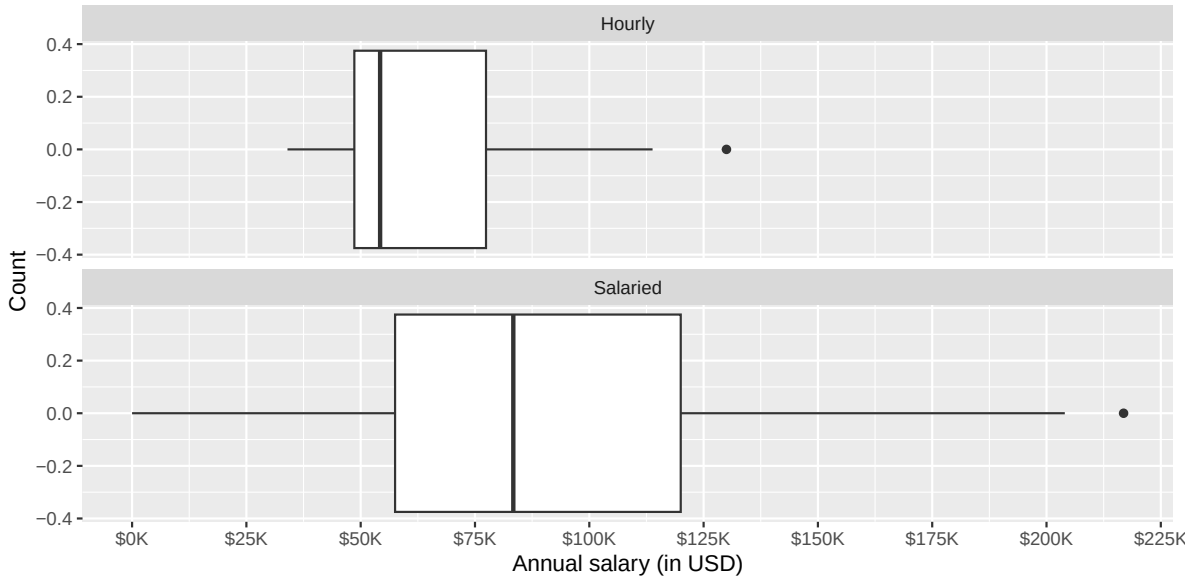
e. The `salary_type` variable is numerical.

f. The `annual_salary` variable is numerical.

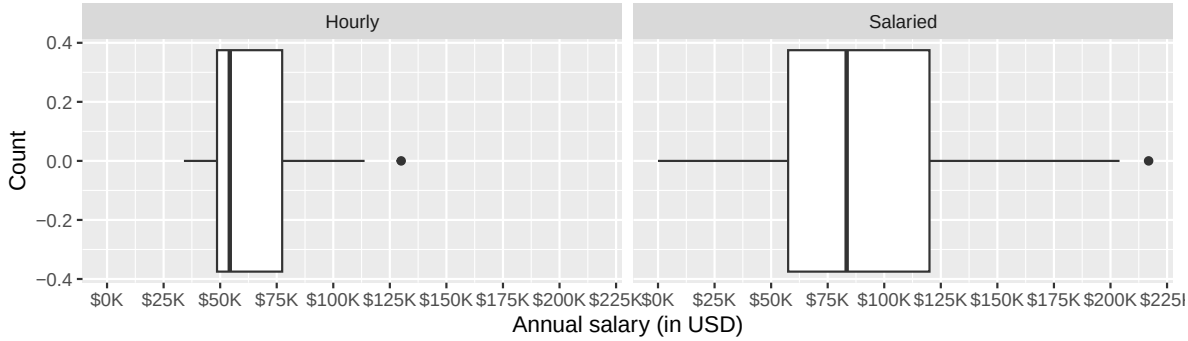
g. The `performance_rating` variable is categorical.

## Question 2

Figure 1a and Figure 1b show the distributions of annual salaries of hourly and salaried workers. The two figures show the same data, with the facets organized across rows and across columns. Which of the two figures is better for comparing the median annual salaries of hourly and salaried workers. Explain your reasoning.




(a) Option 1




(b) Option 2

Figure 1: Distribution of annual salaries of Blizzard employees

## Question 3

Suppose your teammate wrote the following code as part of their analysis of the data.

They then printed out the results shown below. Unfortunately one of the numbers got erased from the printout. It's indicated with `_____` below.

```
# A tibble: 2 × 3
  salary_type mean_annual_salary median_annual_salary
  <chr>                    <dbl>                <dbl>
1 Hourly                  63003.               54246.
2 Salaried                90183.               _____
```

Which of the following is the best estimate for that erased value?

a. 30,000

b. 50,000

c. 80,000

d. 100,000

## Question 4

Which distribution of annual salaries has a higher variance?

a. Hourly workers

b. Salaried workers

c. Roughly the same

## Question 5

Which of the following plots are be useful for comparing the distributions of annual salaries of hourly and salaried workers? Choose all that apply.

a. Box plots

b. Density plots

c. Pie charts

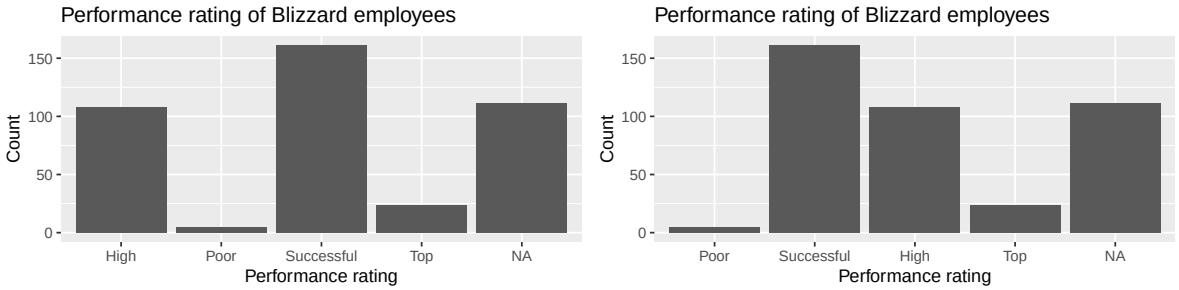
d. Bar charts

e. Histograms

f. Scatterplots

## Questions 6 and 7

Suppose you made the bar plot shown in Figure 2a to visualize the distribution of `performance_rating` and your teammate made the bar plot shown in Figure 2b.




(a) Option 1

(b) Option 2

Figure 2: Distribution of performance rating

You made your bar plot without transforming the data in any way, while your friend did first transform the data with code like the following:

```
blizzard_salary <- blizzard_salary |>
  _(1)_(performance_rating = fct_relevel(performance_rating, c(_(2)_)))
```

**Question 6:** What goes in the blank (1)?

a. `arrange()`

b. `filter()`

c. `mutate()`

d. `summarize()`

**Question 7:** What goes in the blank (2)?

a. `"Poor", "Successful", "High", "Top"`

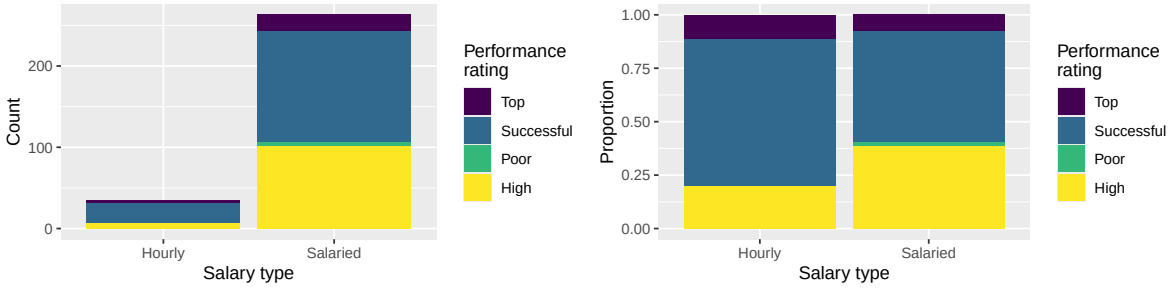
b. `"Successful", "High", "Top"`

c. `"Top", "High", "Successful", "Poor"`

d. `Poor, Successful, High, Top`

## Questions 8 - 10

Finally, another teammate creates the following two plots.




(a) Option 1

(b) Option 2

Figure 3: Distribution of salary type by performance rating

**Question 8:** Your teammate asks you for help deciding which one to use in the final report for visualizing the relationship between performance rating and salary type. In 1-3 sentences, can you help them make a decision, justify your choice, and write the narrative that should go with the plot?

**Question 9:** A friend with a keen eye points out that the number of observations in Figure 3a seems lower than the total number of observations in `blizzard_salary`. What might be going on here? Explain your reasoning.

**Question 10:** Below are the proportions of performance ratings for hourly and salaried workers. Place these values in the corresponding segments in Figure 3b.

```
# A tibble: 4 x 3
  performance_rating Hourly Salaried
  <chr>               <dbl>    <dbl>
1 High                0.2     0.384
2 Successful          0.686   0.521
3 Top                 0.114   0.0760
4 Poor                0       0.0190
```

## Questions 11 and 12

The table below shows the distribution of `salary_type` and `performance_rating`.

```
# A tibble: 2 x 6
  salary_type  Poor Successful  High   Top  `NA`
  <chr>       <int>      <int> <int> <int> <int>
1 Hourly         NA         24     7     4    28
2 Salaried        5        137   101    20    83
```

The pipeline below produces a data frame with a fewer number of rows than `blizzard_salary`.

```
blizzard_salary |>
  filter(salary_type _(1)_ "Hourly" _(2)_ performance_rating == "Poor") |>
  _(3)_(annual_salary)
```

```
# A tibble: 5 x 4
  percent_incr salary_type annual_salary performance_rating
         <dbl> <chr>               <dbl> <chr>
1            0 Salaried            80000 Poor
2            3 Salaried            83000 Poor
3            0 Salaried           116000 Poor
4            0 Salaried           135219 Poor
5            0 Salaried           147500 Poor
```

**Question 11:** Which of the following goes in blanks (1) and (2)?

| | (1) | (2) |
|---|---|---|
| a. | `!=` | `\|` |
| b. | `==` | `&` |
| c. | `!=` | `&` |
| d. | `==` | `\|` |

**Question 12:** Which function or functions go into blank (3)?

a. `arrange()`

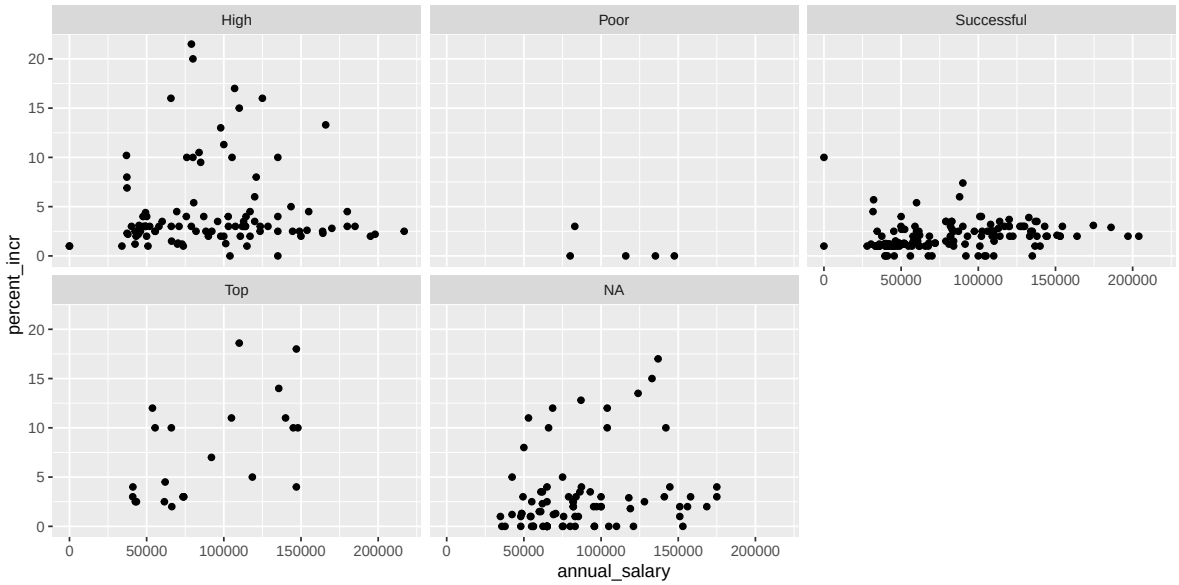
b. `mutate()`

c. `order()`

d. `sort()`

## Question 13

You're reviewing another team's work and they made the following visualization:




And they wrote the following interpretation for the relationship between annual salary and percent increase for Top performers:

> The relationship is positive, having a higher salary causes in a higher percent increase. There is one clear outlier.

Which of the following is/are the most accurate and helpful peer review note for this interpretation? Choose all that apply.

a. The interpretation is complete and perfect, no changes needed!

b. The interpretation doesn't mention the direction of the relationship.

c. The interpretation doesn't mention the form of the relationship, which is linear.

d. There isn't a clear outlier in the plot. If any points stand out as potential outliers, more guidance should be given to the reader to identify them (e.g., salary and/or percent increase amount).

e. The interpretation is causal – we don't know if the cause of the high percent increase is higher annual salary based on observational data. The causal direction might be the other way around, or there may be other factors contributing to the apparent relationship.

> **Tip**
>
> We will talk more about point (e) on Monday.

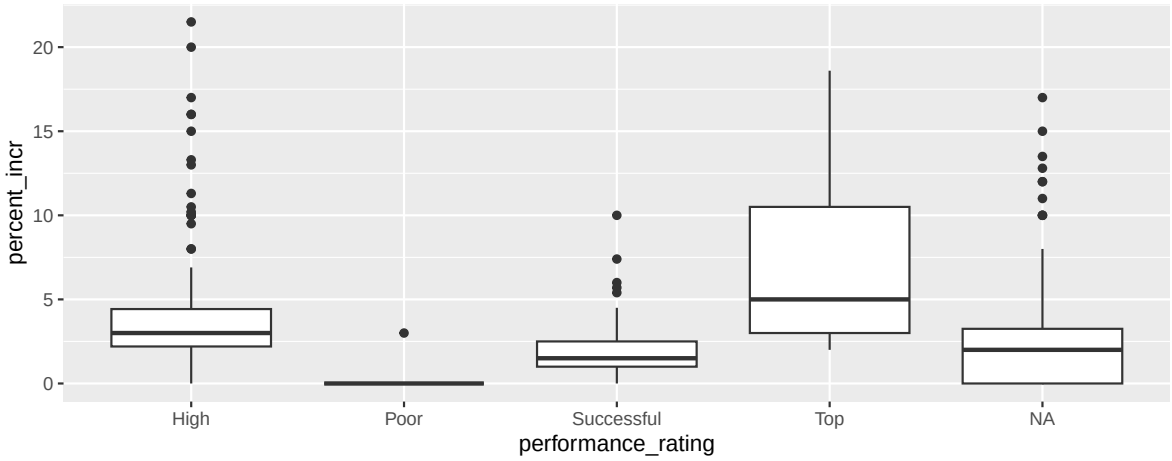
## Question 14

Below is some code and its output.

```
```{r}
# label=plot_blizzard

ggplot(blizzard_salary,aes(x=performance_rating,y=percent_incr))+geom_boxplot()
labs(x="Performance rating", y = "Percent increase")
```
```

```
Warning: Removed 39 rows containing non-finite outside the scale range
(`stat_boxplot()`).
```




```
$x
[1] "Performance rating"

$y
[1] "Percent increase"

attr(,"class")
[1] "labels"
```

Part 1: List at least 3 things things that should be improved/fixed in this code!

Part 2: What is the cause of the warning and what does it mean?

## Question 15

You're working on a data analysis on salaries of Blizzard employees in a Quarto document in a project version controlled by Git. You create a plot and write up a paragraph describing any patterns in it. Then, your teammate says "render, commit, and push".

Part 1: What do they mean by each of these three steps. In 1-2 sentences for each, explain in your own words what they mean.

1. Render:

2. Commit:

3. Push:

Part 2: Your teammate is getting impatient and they interrupt you after you rendered and committed and say "I still can't see your changes in our shared GitHub repo when I look at it in my web browser." Which of the following answers is the most accurate?

a. I rendered my document, you should be seeing my changes on GitHub when you look at it in your web browser.

b. I committed my changes, you should be seeing my changes on GitHub when you look at it in your web browser.

c. I didn't yet push my changes, it's expected that you are not seeing them on GitHub when you look at it in your web browser. Wait until I push, and check again.

d. You need to pull to see my changes on GitHub in the web browser.

## Good Practice

Pick a concept we introduced in class so far that you've been struggling with and explain it in your own words.