

Analyze Transfer Student Data and Recommend a Policy Change

Project Overview: For many years, if a University of Colorado undergraduate student in one of the other schools and colleges wants to transfer to Leeds, they need an overall GPA of 3.0 or higher and B- or better in MATH 1112, ECON 2010, ECON 2020, and a statistics course. Further, if they had taken BCOR 1015 (a business course), they needed to earn a C or better in the course. As the “direct admission” (admission from high school directly) to Leeds has become more competitive, the number of students rejected from Leeds but admitted to CU has grown, and with it the number of students who successfully transfer in. The associate dean of undergraduate programs wants to raise the standards for transferring into Leeds. This will reduce the number of transfer students, which will make the classes easier to schedule. To reduce the number of transfer students by approximately 25%, how do you suggest she change the standard? What if she wanted to reduce the number by 50%, then what do you recommend? Use the data in the attached files to inform your recommendation. There is one file per semester. Each row in a file represents a student who successfully transferred to Leeds.

In [1]:

```
# Loading necessary packages
```

```
library(tidyverse)
library(readxl)
library(writexl)
library(dplyr)
library(ggplot2)
```

```
— Attaching core tidyverse packages ————— tidyverse 2.0.0 —
```

```
✓ dplyr     1.1.4      ✓ readr     2.1.4
✓forcats    1.0.0      ✓ stringr   1.5.1
✓ ggplot2   3.4.4      ✓ tibble    3.2.1
✓ lubridate 1.9.3      ✓ tidyr    1.3.0
✓ purrr    1.0.2
```

```
— Conflicts ————— tidyverse_conflicts() —
```

```
✗ dplyr::filter() masks stats::filter()
✗ dplyr::lag()    masks stats::lag()
```

```
i Use the conflicted package (<http://conflicted.r-lib.org/>) to force all conflicts to become errors
```

In [2]:

```
# Combined Excel
allStud <- read_excel('../input/transfer-student-data/combined.xlsx')
allStud

# Number of students in total
paste( "The total number of transfer students are", nrow(allStud), sep=" ")

# Semester-wise student list

spring21 <- read_excel('../input/transfer-student-data/S21-Admitted-IUTs.xlsx')

fall21 <- read_excel('../input/transfer-student-data/F21-Admitted-IUTs.xlsx')

spring22 <- read_excel('../input/transfer-student-data/S22-Admitted-IUTs.xlsx')

fall22 <- read_excel('../input/transfer-student-data/F22-Admitted-IUTs.xlsx')

spring23 <- read_excel('../input/transfer-student-data/S23-Admitted-IUTs.xlsx')

# Number of students admitted in each semester

paste( "The spring 2021 semester has", nrow(spring21), "students admitted", sep=" ")
paste( "The spring 2021 semester has", nrow(fall21), "students admitted", sep=" ")
paste( "The spring 2021 semester has", nrow(spring22), "students admitted", sep=" ")
paste( "The spring 2021 semester has", nrow(fall22), "students admitted", sep=" ")
paste( "The spring 2021 semester has", nrow(spring23), "students admitted", sep=" ")
```

A tibble: 908 × 9

Cumulative GPA	ECON 2010	ECON 2020	MATH 1112	MATH 2510	Stats Course not MATH 2510	BCOR 1015	Stats	Stats Course not 2510
<dbl>	<chr>	<chr>	<chr>	<chr>	<chr>	<chr>	<chr>	<chr>
3.223	TB	A	B	B	NA	NA	NA	NA
3.035	B+	B	B	B-	NA	NA	NA	NA
3.237	B+	A	B	B	NA	NA	NA	NA
3.150	B	B	B	B-	NA	NA	NA	NA
3.237	B	B	B-	A-	BCOR 1025	A-	NA	NA
3.188	TA	TA-	B-	B-	BCOR 1025	NA	NA	NA
3.920	A-	A-	A	A	BCOR 1025	NA	NA	NA
3.035	B	B	B	A-	NA	NA	NA	NA
3.348	B	A	B+	B	NA	NA	NA	NA
3.626	A	A	A	A	NA	NA	NA	NA
3.404	B+	A-	B+	B+	SOCY 2061	NA	NA	NA
3.140	B-	B+	B+	B-	NA	NA	NA	NA
3.000	B	B	B	A-	SOCY 2061	NA	NA	NA
3.259	B-	A	B+	B-	NA	NA	NA	NA
3.233	A-	B+	B-	B	SOCY 2061	NA	NA	NA
3.600	A-	B	A	A-	NA	NA	NA	NA
3.069	B	B+	B	A	NA	NA	NA	NA
3.093	B-	B	A	B	NA	NA	NA	NA
3.630	A-	A	A	A-	SOCY 2061	NA	NA	NA
3.724	B	A-	A	A	PSCI 2075	NA	NA	NA
3.043	B-	B	A-	B	NA	NA	NA	NA
3.242	B-	A-	B	B+	SOCY 2061	NA	NA	NA
3.481	B-	A	B+	A	NA	NA	NA	NA
3.011	B-	B	B-	B	NA	NA	NA	NA
3.030	A	A	A	A-	NA	C	NA	NA

Cumulative GPA	ECON 2010	ECON 2020	MATH 1112	MATH 2510	Stats Course not MATH 2510	BCOR 1015	Stats	Stats Course not 2510
<dbl>	<chr>	<chr>	<chr>	<chr>	<chr>	<chr>	<chr>	<chr>
3.337	B-	A	B+	B+	NA	NA	NA	NA
3.611	A-	A	A-	A	NA	NA	NA	NA
3.554	B+	B+	A-	A	NA	NA	NA	NA
3.729	A-	A-	A-	A	PSYC 2111	A-	NA	NA
3.208	B	A	A-	B-	NA	NA	NA	NA
:	:	:	:	:	:	:	:	:
3.844	A	B	A	A	NA	NA	NA	NA
3.195	B	A	A	B	NA	NA	NA	SOCY 2061
3.344	B	A-	B	B+	NA	NA	NA	PSCI 2075
3.532	A-	A	A	B-	NA	NA	NA	NA
3.424	B	B	B+	B+	NA	NA	NA	NA
3.703	B+	A	B	A	NA	A	NA	NA
3.576	A	A	A-	B	NA	NA	NA	NA
3.083	P+ (B)	A-	A-	B+	NA	NA	NA	NA
3.526	A-	A	A	B+	NA	NA	NA	NA
3.700	A	A-	A	A	NA	NA	NA	NA
3.954	A	A	A	A	NA	NA	NA	NA
3.485	B+	A	A	B	NA	NA	NA	INFO1301
3.321	A	A	A	A	NA	NA	NA	SOCY 2061
3.961	A	A	A	A	NA	A-	NA	NA
3.492	B	A	A	A	NA	NA	NA	NA
3.140	A-	B	B	A-	NA	NA	NA	PSCI 2075
3.356	A	B+	B	A-	NA	NA	NA	SOCY 2061
3.245	A	A	B+	B	NA	NA	NA	NA
3.169	B	B	B	A	NA	NA	NA	NA
3.086	B-	B	B+	B	NA	NA	NA	NA
3.255	A-	B+	A	B+	NA	NA	NA	NA
3.514	B-	A-	A	B	NA	NA	NA	NA

Cumulative GPA	ECON 2010	ECON 2020	MATH 1112	MATH 2510	Stats Course not MATH 2510	BCOR 1015	Stats	Stats Course not 2510
<dbl>	<chr>	<chr>	<chr>	<chr>	<chr>	<chr>	<chr>	<chr>
3.644	A-	A-	A	A	NA	NA	NA	PSCI 2075
3.149	B-	B+	A	A	NA	NA	NA	NA
3.897	A	A	A	B+	NA	NA	NA	NA
3.297	A	A-	B-	B+	NA	NA	NA	SOCY 2061
3.278	B-	B+	B+	A-	NA	NA	NA	NA
3.959	A	TA	A	A	NA	NA	NA	NA
3.303	B	A	B	B+	NA	NA	NA	NA
3.202	B	A	B	A	NA	NA	NA	NA

'The total number of transfer students are 908'

'The spring 2021 semester has 149 students admitted'

'The spring 2021 semester has 306 students admitted'

'The spring 2021 semester has 110 students admitted'

'The spring 2021 semester has 182 students admitted'

'The spring 2021 semester has 161 students admitted'

In [3]:

```
# Table for each dataset

names(spring21)
table(spring21$'ECON 2010')
table(spring21$'ECON 2020')
table(spring21$'MATH 1112')
table(spring21$'MATH 2510')
table(spring21$'Stats Course not 2510')
table(spring21$'BCOR 1015')

names(fall21)
table(fall21$'ECON 2010')
table(fall21$'ECON 2020')
table(fall21$'MATH 1112')
table(fall21$'MATH 2510')
table(fall21$'Stats Course not MATH 2510')
table(fall21$'BCOR 1015')

names(spring22)
table(spring22$'ECON 2010')
table(spring22$'ECON 2020')
table(spring22$'MATH 1112')
table(spring22$'MATH 2510')
table(spring22$'Stats Course not 2510')
table(spring22$'BCOR 1015')

names(fall22)
table(fall22$'ECON 2010')
table(fall22$'ECON 2020')
table(fall22$'MATH 1112')
```

```
table(fall22$'MATH 2510')
table(fall22$'Stats')
table(fall22$'BCOR 1015')

names(spring23)
table(spring23$'ECON 2010')
table(spring23$'ECON 2020')
table(spring23$'MATH 1112')
table(spring23$'MATH 2510')
table(spring23$'Stats Course not 2510')
table(spring23$'BCOR 1015')

names(allStud)
table(allStud$'ECON 2010')
table(allStud$'ECON 2020')
table(allStud$'MATH 1112')
table(allStud$'MATH 2510')
table(allStud$'Stats Course not MATH 2510')
table(allStud$'BCOR 1015')
table(allStud$'Stats')
table(allStud$'Stats Course not 2510')
```

'Cumulative GPA' · 'ECON 2010' · 'ECON 2020' · 'MATH 1112' · 'MATH 2510' · 'Stats Course not 2510' · 'BCOR 1015'

A	A-	B	B-	B+	P+	(B-)	P+	(B)	P+	(B+)	TA	TA-
17	22	39	19	23	1		3		1		17	1
TB	TB-											
4	2											

A	A-	AP	B	B-	B+	P	(B-)	P	(C+)	P+	(B)	P+	(B+)
30	20	1	37	16	21	1		1		2		1	
T	TA	TA-	TB	TB+									
1	8	1	8	1									

A	A-	A+	B	B-	B+	B+	(SU20)	P	(C+)
49	27	1	36	9	22		1		1
P+ (B)	P+ (B+)								
1	2								

A	A-	B	B-	B+	P+	(B-)	P+	(B)	TA	TB	TB+
37	26	34	14	19	2		4		7	5	1

BCOR 1025	P+	PSCI 2075	PSCI2075	SOCY 2061	SOCY2061
2	1	1	5	3	7

A	A-	B	B-	B+	C	C-	C+	P+	P+ (B)
3	4	12	9	7	2	2	1	5	1

'Cumulative GPA' · 'ECON 2010' · 'ECON 2020' · 'MATH 1112' · 'MATH 2510' · 'Stats Course not MATH 2510' · 'BCOR 1015'

A	A-	A+	AP	B	B (P+)	B-	B- (P+)	B+	T
38	38	2	6	84	3	52	1	53	1
TA	TA-	TB	TB-						
13	1	13	1						

A	A-	A+	AP	B	B-	B+	TA	TA-	TB	TB-	TB+
72	56	1	8	73	22	47	12	3	10	1	1

A	A-	A+	B	B-	B+	TA	TB	TB-	TB+	
101			61		2		59		35	47

Exempt Exam

1

A	A-	A+	B	B-	B+	TA	TB	TB-
82	54	3	76	38	44	5	3	1

APPM	3570	BCOR	1025	ECON	3818	INFO	1301	psci	2075	PSCI	2075	psci	2075	PSYC	2111
	1			5		1		1		1	10		1		2
psyc	2111	socy	2061	SOCY	2061										

1 15 34

A	A-	B	B-	B+	C	C+
8	9	8	5	3	1	1

'Cumulative GPA' · 'ECON 2010' · 'ECON 2020' · 'MATH 1112' · 'MATH 2510' · 'Stats Course not 2510' · 'BCOR 1015'

A	A-	AP	B	B-	B+	TA	TB	TB+
13	9	1	38	24	16	6	2	1

A	A-	AP	B	B-	B+	TA	TB	TB+
25	26	2	17	15	19	3	2	1

A	A-	B	B-	B+	Exempt
21	28	32	13	14	2

A	A-	B	B-	B+	TA	TB
29	17	21	12	24	2	5

BCOR 1025	IPHY2800	PSCI 2075	PSYC 2111	SOCY 2061	STAT 3100
3	1	2	1	12	1

A	A-	B-	B+	C	C+	P+
2	1	5	1	4	2	1

'Cumulative GPA' · 'ECON 2010' · 'ECON 2020' · 'MATH 1112' · 'MATH 2510' · 'Stats' · 'BCOR 1015'

A	A-	A+	AP	B	B-	B+	TA	TA-	TB	TB-
28	21	1	3	43	36	33	10	1	5	1

A	A-	A+	AP	B	B-	B+	TA	TB	TB-	TB+
39	26	2	2	47	20	32	5	7	1	1

A	A-	A+	B	B-	B+
59	45	1	37	17	23

A	A-	A+	B	B-	B+	TA	TB	TB-	TB+
58	32	1	39	22	22	2	4	1	1

BCOR	1025	BCOR1025	ECON	3818	INFO	1301	PSCI	2075	PSCY2111	SOCY	2061
2		1		1		2		10		1	25

A	A-	B	B-	B+	C	C-	C+
3	1	2	3	1	1	1	3

'Cumulative GPA' · 'ECON 2010' · 'ECON 2020' · 'MATH 1112' · 'MATH 2510' · 'Stats Course not 2510' · 'BCOR 1015'

A	A-	A+	AP	B	B-	B+	P+	(B)	TA	TB	TB-
41	27	1	1	37	25	15	1	1	9	2	2

A	A-	AP	B	B-	B+	TA	TA-	TB	TB-	TB+
44	25	2	29	17	26	11	1	3	1	2

A	A-	A+	B	B-	B+
53	22	1	36	15	34

A	A-	B	B-	B+	TA	TA-	TB	TB-
51	26	34	18	26	3	1	1	1

BCOR	1025	INFO	1301	INFO1301	IPHY	3280	MAT135	MATH	2510	PSCI	2075	PSYC2111
	3		2		1		2		1		1	
SOCY	2061											
	20											

A	A-	B	B-	B+	C	C+
2	2	5	5	2	2	2

'Cumulative GPA' · 'ECON 2010' · 'ECON 2020' · 'MATH 1112' · 'MATH 2510' · 'Stats Course not MATH 2510' ·

'BCOR 1015' · 'Stats' · 'Stats Course not 2510'

A	A-	A+	AP	B	B (P+)	B- B- (P+)	B+ P+ (B-)
137	117	4	11	241	3	156 1	140 1
P+ (B)	P+ (B+)	T	TA	TA-	TB	TB- TB+	
4	1	1	55	3	26	6 1	

A	A-	A+	AP	B	B-	B+	P (B-)	P (C+)	P+ (B)
210	153	3	15	203	90	145	1	1	2
P+ (B+)	T	TA	TA-	TB	TB-	TB+			
1	1	39	5	30	3	6			

A	A-	A+	B	B-	B+
283	183	5	200	89	140
B+ (SU20)	Exempt	Exempt	Exam	P (C+)	P+ (B)
1	2	1	1	1	2

A	A-	A+	B	B-	B+	P+ (B-)	P+ (B)	TA	TA-
257	155	4	204	104	135	2	4	19	1
TB	TB-	TB+							
18	3	2							

APPM 3570	BCOR 1025	ECON3818	INFO 1301	psci 2075	PSCI 2075	pisci2075	PSYC 2111		
1	5	1	1	1	1	10	1	2	
psyc2111	socy 2061	SOCY 2061							
1	15	34							

A	A-	B	B-	B+	C	C-	C+	P+ P+ (B)
18	17	27	27	14	10	3	9	6 1

BCOR 1025	BCOR1025	ECON 3818	INFO 1301	PSCI 2075	PSCY2111	SOCY 2061		
2	1	1	2	10	1	25		

BCOR	1025	INFO	1301	INFO1301	IPHY	3280	IPHY2800	MAT135	MATH	2510	P+
	8		2	1		2	1	1		1	1
PSCI	2075	PSCI2075	PSYC	2111	PSYC2111	SOCY	2061	SOCY2061	STAT	3100	
	11		5		1		1	35	7	1	

In [4]:

```
# Cleaning Data in the combined student file

allStud$'ECON 2010'[allStud$'ECON 2010' == 'B- (P+)' ] <- 'B-'
allStud$'ECON 2010'[allStud$'ECON 2010' == 'B (P+)' ] <- 'B'
allStud$'ECON 2010'[allStud$'ECON 2010' == 'P+ (B-)' ] <- 'B-'
allStud$'ECON 2010'[allStud$'ECON 2010' == 'P+ (B+)' ] <- 'B+'
allStud$'ECON 2010'[allStud$'ECON 2010' == 'P+ (B)' ] <- 'B'
allStud$'ECON 2010'[allStud$'ECON 2010' == 'T' ] <- 'AP'
allStud$'ECON 2010'[allStud$'ECON 2010' == 'TA' ] <- 'A'
allStud$'ECON 2010'[allStud$'ECON 2010' == 'TA-' ] <- 'A-'
allStud$'ECON 2010'[allStud$'ECON 2010' == 'TB' ] <- 'B'
allStud$'ECON 2010'[allStud$'ECON 2010' == 'TB-' ] <- 'B-'
allStud$'ECON 2010'[allStud$'ECON 2010' == 'TB+' ] <- 'B+'

allStud$'ECON 2020'[allStud$'ECON 2020' == 'P (B-)' ] <- 'B-'
allStud$'ECON 2020'[allStud$'ECON 2020' == 'P (C+)' ] <- 'C+'
allStud$'ECON 2020'[allStud$'ECON 2020' == 'P+ (B)' ] <- 'B'
allStud$'ECON 2020'[allStud$'ECON 2020' == 'P+ (B+)' ] <- 'B+'
allStud$'ECON 2020'[allStud$'ECON 2020' == 'T' ] <- 'AP'
allStud$'ECON 2020'[allStud$'ECON 2020' == 'TA' ] <- 'A'
allStud$'ECON 2020'[allStud$'ECON 2020' == 'TA-' ] <- 'A-'
allStud$'ECON 2020'[allStud$'ECON 2020' == 'TB' ] <- 'B'
allStud$'ECON 2020'[allStud$'ECON 2020' == 'TB-' ] <- 'B-'
allStud$'ECON 2020'[allStud$'ECON 2020' == 'TB+' ] <- 'B+'

allStud$'MATH 1112'[allStud$'MATH 1112' == 'B+ (SU20)' ] <- 'B+'
allStud$'MATH 1112'[allStud$'MATH 1112' == 'Exempt' ] <- 'AP'
allStud$'MATH 1112'[allStud$'MATH 1112' == 'Exempt Exam' ] <- 'AP'
```

```
allStud$'MATH 1112'[allStud$'MATH 1112' == 'P (C+)'] <- 'C+'  
allStud$'MATH 1112'[allStud$'MATH 1112' == 'P+ (B)'] <- 'B'  
allStud$'MATH 1112'[allStud$'MATH 1112' == 'P+ (B+)'] <- 'B+'
```

```
allStud$'MATH 2510'[allStud$'MATH 2510' == 'P+ (B-)'] <- 'B-'  
allStud$'MATH 2510'[allStud$'MATH 2510' == 'P+ (B)'] <- 'B'  
allStud$'MATH 2510'[allStud$'MATH 2510' == 'TA'] <- 'A'  
allStud$'MATH 2510'[allStud$'MATH 2510' == 'TA-'] <- 'A-'  
allStud$'MATH 2510'[allStud$'MATH 2510' == 'TB'] <- 'B'  
allStud$'MATH 2510'[allStud$'MATH 2510' == 'TB-'] <- 'B-'  
allStud$'MATH 2510'[allStud$'MATH 2510' == 'TB+'] <- 'B+'
```

```
allStud$'BCOR 1015'[allStud$'BCOR 1015' == 'P+'] <- 'B-'  
allStud$'BCOR 1015'[allStud$'BCOR 1015' == 'P+ (B)'] <- 'B'
```

```
allStud$'Stats Course not MATH 2510'[allStud$'Stats Course not MATH 2510' == 'psci2075'] <- 'PSCI 2075'  
allStud$'Stats Course not MATH 2510'[allStud$'Stats Course not MATH 2510' == 'psci 2075'] <- 'PSCI 2075'  
allStud$'Stats Course not MATH 2510'[allStud$'Stats Course not MATH 2510' == 'psyc2111'] <- 'PSYC 2111'  
allStud$'Stats Course not MATH 2510'[allStud$'Stats Course not MATH 2510' == 'socy 2061'] <- 'SOCY 2061'  
allStud$'Stats Course not MATH 2510'[allStud$'Stats Course not MATH 2510' == 'ECON3818'] <- 'ECON 3818'
```

```
allStud$'Stats Course not 2510'[allStud$'Stats Course not 2510' == 'INFO1301'] <- 'INFO 1301'  
allStud$'Stats Course not 2510'[allStud$'Stats Course not 2510' == 'PSCI2075'] <- 'PSCI 2075'
```

```
allStud$'Stats Course not 2510'[allStud$'Stats Course not 2510' == 'PSYC2111'] <- 'PSYC 2111'
allStud$'Stats Course not 2510'[allStud$'Stats Course not 2510' == 'SOCY2061'] <- 'SOCY 2061'
allStud$'Stats Course not 2510'[allStud$'Stats Course not 2510' == 'IPHY2800'] <- 'IPHY 2800'
allStud$'Stats Course not 2510'[allStud$'Stats Course not 2510' == 'P+'] <- 'PSCI 2075'
allStud$'Stats Course not 2510'[allStud$'Stats Course not 2510' == 'MAT135'] <- 'MATH 135'
```

```
allStud$'Stats'[allStud$'Stats' == 'BCOR1025'] <- 'BCOR 1025'
allStud$'Stats'[allStud$'Stats' == 'PSCY2111'] <- 'PSYC 2111'
```

```
allStud <- subset(allStud, allStud$`Cumulative GPA` >= 3.0)
```

Cleaning Data in the semester-wise files

Spring21

```
spring21$'ECON 2010'[spring21$'ECON 2010' == 'P+ (B-)'] <- 'B-'
spring21$'ECON 2010'[spring21$'ECON 2010' == 'P+ (B)'] <- 'B'
spring21$'ECON 2010'[spring21$'ECON 2010' == 'P+ (B+)'] <- 'B+'
spring21$'ECON 2010'[spring21$'ECON 2010' == 'TA'] <- 'A'
spring21$'ECON 2010'[spring21$'ECON 2010' == 'TA-'] <- 'A-'
spring21$'ECON 2010'[spring21$'ECON 2010' == 'TB'] <- 'B'
spring21$'ECON 2010'[spring21$'ECON 2010' == 'TB-'] <- 'B-'
```

```
spring21$'ECON 2020'[spring21$'ECON 2020' == 'P (B-)'] <- 'B-'
spring21$'ECON 2020'[spring21$'ECON 2020' == 'P (C+)'] <- 'C+'
spring21$'ECON 2020'[spring21$'ECON 2020' == 'P+ (C+)'] <- 'C+'
spring21$'ECON 2020'[spring21$'ECON 2020' == 'P+ (B)'] <- 'B'
spring21$'ECON 2020'[spring21$'ECON 2020' == 'P+ (B+)'] <- 'B+'
spring21$'ECON 2020'[spring21$'ECON 2020' == 'T'] <- 'B-'
spring21$'ECON 2020'[spring21$'ECON 2020' == 'TA'] <- 'A'
```

```

spring21$'ECON 2020'[spring21$'ECON 2020' == 'TA-'] <- 'A-'
spring21$'ECON 2020'[spring21$'ECON 2020' == 'TB'] <- 'B'
spring21$'ECON 2020'[spring21$'ECON 2020' == 'TB+'] <- 'B+'


spring21$'MATH 1112'[spring21$'MATH 1112' == 'B+ (SU20)'] <- 'B+'
spring21$'MATH 1112'[spring21$'MATH 1112' == 'P+ (B)'] <- 'B'
spring21$'MATH 1112'[spring21$'MATH 1112' == 'P+ (B+)'] <- 'B+'
spring21$'MATH 1112'[spring21$'MATH 1112' == 'P (C+)'] <- 'C+'


spring21$'MATH 2510'[spring21$'MATH 2510' == 'P+ (B-)'] <- 'B-'
spring21$'MATH 2510'[spring21$'MATH 2510' == 'P+ (B)'] <- 'B'
spring21$'MATH 2510'[spring21$'MATH 2510' == 'TA'] <- 'A'
spring21$'MATH 2510'[spring21$'MATH 2510' == 'TB'] <- 'B'
spring21$'MATH 2510'[spring21$'MATH 2510' == 'TB+'] <- 'B+'


spring21$'BCOR 1015'[spring21$'BCOR 1015' == 'P+'] <- 'B-'
spring21$'BCOR 1015'[spring21$'BCOR 1015' == 'P+ (B)'] <- 'B'


## Fall21
fall21$'ECON 2010'[fall21$'ECON 2010' == 'B- (P+)'] <- 'B-'
fall21$'ECON 2010'[fall21$'ECON 2010' == 'B (P+)'] <- 'B'
fall21$'ECON 2010'[fall21$'ECON 2010' == 'TA'] <- 'A'
fall21$'ECON 2010'[fall21$'ECON 2010' == 'T'] <- 'B-'
fall21$'ECON 2010'[fall21$'ECON 2010' == 'TA-'] <- 'A-'
fall21$'ECON 2010'[fall21$'ECON 2010' == 'TB'] <- 'B'
fall21$'ECON 2010'[fall21$'ECON 2010' == 'TB-'] <- 'B-'


fall21$'ECON 2020'[fall21$'ECON 2020' == 'TA'] <- 'A'
fall21$'ECON 2020'[fall21$'ECON 2020' == 'TA-'] <- 'A-'
fall21$'ECON 2020'[fall21$'ECON 2020' == 'TB'] <- 'B'
fall21$'ECON 2020'[fall21$'ECON 2020' == 'TB-'] <- 'B-'

```

```
fall121$'ECON 2020'[fall121$'ECON 2020' == 'TB+' ] <- 'B+'  
  
fall121$'MATH 1112'[fall121$'MATH 1112' == 'Exempt Exam' ] <- 'AP'  
  
fall121$'MATH 2510'[fall121$'MATH 2510' == 'TA' ] <- 'A'  
fall121$'MATH 2510'[fall121$'MATH 2510' == 'TB' ] <- 'B'  
fall121$'MATH 2510'[fall121$'MATH 2510' == 'TB-' ] <- 'B-'  
  
## Spring22  
spring22$'ECON 2010'[spring22$'ECON 2010' == 'TA' ] <- 'A'  
spring22$'ECON 2010'[spring22$'ECON 2010' == 'TB' ] <- 'B'  
spring22$'ECON 2010'[spring22$'ECON 2010' == 'TB+' ] <- 'B+'  
  
spring22$'ECON 2020'[spring22$'ECON 2020' == 'TA' ] <- 'A'  
spring22$'ECON 2020'[spring22$'ECON 2020' == 'TB' ] <- 'B'  
spring22$'ECON 2020'[spring22$'ECON 2020' == 'TB+' ] <- 'B+'  
  
spring22$'MATH 1112'[spring22$'MATH 1112' == 'Exempt' ] <- 'AP'  
  
spring22$'MATH 2510'[spring22$'MATH 2510' == 'TA' ] <- 'A'  
spring22$'MATH 2510'[spring22$'MATH 2510' == 'TB' ] <- 'B'  
  
spring22$'BCOR 1015'[spring22$'BCOR 1015' == 'P+' ] <- 'B-'  
  
## Fall 22  
fall122$'ECON 2010'[fall122$'ECON 2010' == 'TA' ] <- 'A'  
fall122$'ECON 2010'[fall122$'ECON 2010' == 'TA-' ] <- 'A-'  
fall122$'ECON 2010'[fall122$'ECON 2010' == 'TB' ] <- 'B'  
fall122$'ECON 2010'[fall122$'ECON 2010' == 'TB-' ] <- 'B-'  
  
fall122$'ECON 2020'[fall122$'ECON 2020' == 'TA' ] <- 'A'
```

```
fall122$'ECON 2020'[fall122$'ECON 2020' == 'TB'] <- 'B'  
fall122$'ECON 2020'[fall122$'ECON 2020' == 'TB-'] <- 'B-'  
fall122$'ECON 2020'[fall122$'ECON 2020' == 'TB+'] <- 'B+'  
  
fall122$'MATH 2510'[fall122$'MATH 2510' == 'TA'] <- 'A'  
fall122$'MATH 2510'[fall122$'MATH 2510' == 'TB'] <- 'B'  
fall122$'MATH 2510'[fall122$'MATH 2510' == 'TB-'] <- 'B-'  
fall122$'MATH 2510'[fall122$'MATH 2510' == 'TB+'] <- 'B+'
```

Spring 23

```
spring23$'ECON 2010'[spring23$'ECON 2010' == 'P+ (B)'] <- 'B'  
spring23$'ECON 2010'[spring23$'ECON 2010' == 'TA'] <- 'A'  
spring23$'ECON 2010'[spring23$'ECON 2010' == 'TB'] <- 'B'  
spring23$'ECON 2010'[spring23$'ECON 2010' == 'TB-'] <- 'B-'
```

```
spring23$'ECON 2020'[spring23$'ECON 2020' == 'TA'] <- 'A'  
spring23$'ECON 2020'[spring23$'ECON 2020' == 'TA-'] <- 'A-'  
spring23$'ECON 2020'[spring23$'ECON 2020' == 'TB'] <- 'B'  
spring23$'ECON 2020'[spring23$'ECON 2020' == 'TB-'] <- 'B-'  
spring23$'ECON 2020'[spring23$'ECON 2020' == 'TB+'] <- 'B+'
```

```
spring23$'MATH 2510'[spring23$'MATH 2510' == 'TA'] <- 'A'  
spring23$'MATH 2510'[spring23$'MATH 2510' == 'TA-'] <- 'A-'  
spring23$'MATH 2510'[spring23$'MATH 2510' == 'TB'] <- 'B'  
spring23$'MATH 2510'[spring23$'MATH 2510' == 'TB-'] <- 'B-'
```

In [5]:

```
# Assigning a CGPA range

nrow(allStud[allStud$'Cumulative GPA' > 3.0, ])

allStud$Category <- rep(NA, times=nrow(allStud))

for ( i in 1:nrow(allStud) ){
    if (allStud$'Cumulative GPA'[i] >= 3 & allStud$'Cumulative GPA'[i] < 3.1){
        allStud$Category[i] = '3.0 - 3.1'
    }
    else if (allStud$'Cumulative GPA'[i] >= 3.1 & allStud$'Cumulative GPA'[i] < 3.2){
        allStud$Category[i] = '3.1 - 3.2'
    }
    else if (allStud$'Cumulative GPA'[i] >= 3.2 & allStud$'Cumulative GPA'[i] < 3.3){
        allStud$Category[i] = '3.2 - 3.3'
    }
    else if (allStud$'Cumulative GPA'[i] >= 3.3 & allStud$'Cumulative GPA'[i] < 3.4){
        allStud$Category[i] = '3.3 - 3.4'
    }
    else if (allStud$'Cumulative GPA'[i] >= 3.4 & allStud$'Cumulative GPA'[i] < 3.5){
        allStud$Category[i] = '3.4 - 3.5'
    }
    else if (allStud$'Cumulative GPA'[i] >= 3.5 & allStud$'Cumulative GPA'[i] < 3.6){
        allStud$Category[i] = '3.5 - 3.6'
    }
    else if (allStud$'Cumulative GPA'[i] >= 3.6 & allStud$'Cumulative GPA'[i] < 3.7){
        allStud$Category[i] = '3.6 - 3.7'
    }
    else if (allStud$'Cumulative GPA'[i] >= 3.7 & allStud$'Cumulative GPA'[i] < 3.8){
        allStud$Category[i] = '3.7 - 3.8'
    }
}
```

```
}

else if (allStud$'Cumulative GPA'[i] >= 3.8 & allStud$'Cumulative GPA'[i] < 3.9){
  allStud$Category[i] = '3.8 - 3.9'
}
else if (allStud$'Cumulative GPA'[i] >= 3.9 & allStud$'Cumulative GPA'[i] <= 4.0){
  allStud$Category[i] = '3.9 - 4.0'
}
}

allStud$Category
table(allStud$'Cumulative GPA')
```

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'3.2 - 3.3' · '3.0 - 3.1' · '3.2 - 3.3' · '3.1 - 3.2' · '3.2 - 3.3' · '3.1 - 3.2' · '3.9 - 4.0' · '3.0 - 3.1' · '3.3 - 3.4' · '3.6 - 3.7' ·
'3.4 - 3.5' · '3.1 - 3.2' · '3.0 - 3.1' · '3.2 - 3.3' · '3.2 - 3.3' · '3.6 - 3.7' · '3.0 - 3.1' · '3.0 - 3.1' · '3.6 - 3.7' · '3.7 - 3.8' ·
'3.0 - 3.1' · '3.2 - 3.3' · '3.4 - 3.5' · '3.0 - 3.1' · '3.0 - 3.1' · '3.3 - 3.4' · '3.6 - 3.7' · '3.5 - 3.6' · '3.7 - 3.8' · '3.2 - 3.3' ·
'3.2 - 3.3' · '3.9 - 4.0' · '3.7 - 3.8' · '3.0 - 3.1' · '3.2 - 3.3' · '3.7 - 3.8' · '3.6 - 3.7' · '3.6 - 3.7' · '3.2 - 3.3' · '3.4 - 3.5' ·
'3.6 - 3.7' · '3.6 - 3.7' · '3.4 - 3.5' · '3.0 - 3.1' · '3.2 - 3.3' · '3.1 - 3.2' · '3.5 - 3.6' · '3.5 - 3.6' · '3.1 - 3.2' · '3.3 - 3.4' ·
'3.6 - 3.7' · '3.8 - 3.9' · '3.0 - 3.1' · '3.0 - 3.1' · '3.4 - 3.5' · '3.5 - 3.6' · '3.0 - 3.1' · '3.6 - 3.7' · '3.4 - 3.5' · '3.5 - 3.6' ·
'3.6 - 3.7' · '3.5 - 3.6' · '3.5 - 3.6' · '3.2 - 3.3' · '3.8 - 3.9' · '3.9 - 4.0' · '3.8 - 3.9' · '3.4 - 3.5' · '3.3 - 3.4' · '3.5 - 3.6' ·
'3.4 - 3.5' · '3.7 - 3.8' · '3.7 - 3.8' · '3.7 - 3.8' · '3.8 - 3.9' · '3.9 - 4.0' · '3.5 - 3.6' · '3.3 - 3.4' · '3.0 - 3.1' · '3.6 - 3.7' ·
'3.4 - 3.5' · '3.9 - 4.0' · '3.3 - 3.4' · '3.2 - 3.3' · '3.4 - 3.5' · '3.5 - 3.6' · '3.4 - 3.5' · '3.1 - 3.2' · '3.1 - 3.2' · '3.2 - 3.3' ·
'3.6 - 3.7' · '3.9 - 4.0' · '3.2 - 3.3' · '3.0 - 3.1' · '3.0 - 3.1' · '3.9 - 4.0' · '3.8 - 3.9' · '3.4 - 3.5' · '3.7 - 3.8' · '3.8 - 3.9' ·
'3.1 - 3.2' · '3.1 - 3.2' · '3.2 - 3.3' · '3.4 - 3.5' · '3.8 - 3.9' · '3.2 - 3.3' · '3.9 - 4.0' · '3.0 - 3.1' · '3.2 - 3.3' · '3.8 - 3.9' ·
'3.7 - 3.8' · '3.1 - 3.2' · '3.3 - 3.4' · '3.3 - 3.4' · '3.4 - 3.5' · '3.1 - 3.2' · '3.9 - 4.0' · '3.1 - 3.2' · '3.0 - 3.1' · '3.6 - 3.7' ·
'3.5 - 3.6' · '3.4 - 3.5' · '3.6 - 3.7' · '3.1 - 3.2' · '3.2 - 3.3' · '3.5 - 3.6' · '3.1 - 3.2' · '3.2 - 3.3' · '3.2 - 3.3' · '3.4 - 3.5' ·
'3.4 - 3.5' · '3.0 - 3.1' · '3.7 - 3.8' · '3.5 - 3.6' · '3.9 - 4.0' · '3.8 - 3.9' · '3.5 - 3.6' · '3.5 - 3.6' · '3.2 - 3.3' · '3.6 - 3.7' ·
'3.5 - 3.6' · '3.9 - 4.0' · '3.2 - 3.3' · '3.1 - 3.2' · '3.8 - 3.9' · '3.5 - 3.6' · '3.6 - 3.7' · '3.0 - 3.1' · '3.8 - 3.9' · '3.7 - 3.8' ·
'3.7 - 3.8' · '3.1 - 3.2' · '3.9 - 4.0' · '3.0 - 3.1' · '3.6 - 3.7' · '3.1 - 3.2' · '3.5 - 3.6' · '3.4 - 3.5' · '3.5 - 3.6' · '3.1 - 3.2' ·
'3.1 - 3.2' · '3.5 - 3.6' · '3.4 - 3.5' · '3.8 - 3.9' · '3.4 - 3.5' · '3.5 - 3.6' · '3.7 - 3.8' · '3.4 - 3.5' · '3.1 - 3.2' · '3.1 - 3.2' ·
'3.5 - 3.6' · '3.8 - 3.9' · '3.0 - 3.1' · '3.0 - 3.1' · '3.0 - 3.1' · '3.8 - 3.9' · '3.1 - 3.2' · '3.1 - 3.2' · '3.8 - 3.9' · '3.5 - 3.6' ·
'3.2 - 3.3' · '3.4 - 3.5' · '3.4 - 3.5' · '3.3 - 3.4' · '3.6 - 3.7' · '3.7 - 3.8' · '3.9 - 4.0' · '3.0 - 3.1' · '3.1 - 3.2' · '3.1 - 3.2' ·
'3.5 - 3.6' · '3.0 - 3.1' · '3.7 - 3.8' · '3.4 - 3.5' · '3.8 - 3.9' · '3.2 - 3.3' · '3.3 - 3.4' · '3.4 - 3.5' · '3.7 - 3.8' · '3.6 - 3.7' ·
.... · '3.6 - 3.7' · '3.1 - 3.2' · '3.7 - 3.8' · '3.0 - 3.1' · '3.4 - 3.5' · '3.1 - 3.2' · '3.1 - 3.2' · '3.3 - 3.4' · '3.6 - 3.7' · '3.0 - 3.1' ·
'3.6 - 3.7' · '3.4 - 3.5' · '3.3 - 3.4' · '3.8 - 3.9' · '3.1 - 3.2' · '3.4 - 3.5' · '3.1 - 3.2' · '3.0 - 3.1' · '3.4 - 3.5' · '3.5 - 3.6' ·
'3.1 - 3.2' · '3.0 - 3.1' · '3.1 - 3.2' · '3.0 - 3.1' · '3.5 - 3.6' · '3.1 - 3.2' · '3.0 - 3.1' · '3.0 - 3.1' · '3.8 - 3.9' · '3.1 - 3.2' ·
'3.3 - 3.4' · '3.5 - 3.6' · '3.2 - 3.3' · '3.0 - 3.1' · '3.4 - 3.5' · '3.6 - 3.7' · '3.2 - 3.3' · '3.1 - 3.2' · '3.0 - 3.1' · '3.1 - 3.2' ·
'3.2 - 3.3' · '3.1 - 3.2' · '3.8 - 3.9' · '3.0 - 3.1' · '3.4 - 3.5' · '3.2 - 3.3' · '3.4 - 3.5' · '3.0 - 3.1' · '3.5 - 3.6' · '3.0 - 3.1' ·

'3.0 - 3.1' · '3.3 - 3.4' · '3.0 - 3.1' · '3.0 - 3.1' · '3.8 - 3.9' · '3.6 - 3.7' · '3.9 - 4.0' · '3.6 - 3.7' · '3.4 - 3.5' · '3.1 - 3.2' ·
'3.0 - 3.1' · '3.0 - 3.1' · '3.5 - 3.6' · '3.0 - 3.1' · '3.2 - 3.3' · '3.1 - 3.2' · '3.5 - 3.6' · '3.8 - 3.9' · '3.0 - 3.1' · '3.2 - 3.3' ·
'3.2 - 3.3' · '3.5 - 3.6' · '3.9 - 4.0' · '3.5 - 3.6' · '3.0 - 3.1' · '3.0 - 3.1' · '3.0 - 3.1' · '3.0 - 3.1' · '3.2 - 3.3' ·
'3.4 - 3.5' · '3.7 - 3.8' · '3.0 - 3.1' · '3.8 - 3.9' · '3.3 - 3.4' · '3.2 - 3.3' · '3.4 - 3.5' · '3.6 - 3.7' · '3.5 - 3.6' · '3.3 - 3.4' ·
'3.0 - 3.1' · '3.2 - 3.3' · '3.1 - 3.2' · '3.1 - 3.2' · '3.1 - 3.2' · '3.0 - 3.1' · '3.1 - 3.2' · '3.6 - 3.7' · '3.0 - 3.1' · '3.3 - 3.4' ·
'3.1 - 3.2' · '3.2 - 3.3' · '3.0 - 3.1' · '3.4 - 3.5' · '3.0 - 3.1' · '3.0 - 3.1' · '3.4 - 3.5' · '3.6 - 3.7' · '3.1 - 3.2' · '3.6 - 3.7' ·
'3.2 - 3.3' · '3.3 - 3.4' · '3.1 - 3.2' · '3.0 - 3.1' · '3.8 - 3.9' · '3.0 - 3.1' · '3.1 - 3.2' · '3.5 - 3.6' · '3.0 - 3.1' · '3.0 - 3.1' ·
'3.0 - 3.1' · '3.0 - 3.1' · '3.3 - 3.4' · '3.2 - 3.3' · '3.0 - 3.1' · '3.3 - 3.4' · '3.0 - 3.1' · '3.0 - 3.1' · '3.2 - 3.3' · '3.0 - 3.1' ·
'3.1 - 3.2' · '3.1 - 3.2' · '3.0 - 3.1' · '3.2 - 3.3' · '3.2 - 3.3' · '3.1 - 3.2' · '3.2 - 3.3' · '3.1 - 3.2' · '3.2 - 3.3' · '3.1 - 3.2' ·
'3.2 - 3.3' · '3.2 - 3.3' · '3.4 - 3.5' · '3.3 - 3.4' · '3.2 - 3.3' · '3.3 - 3.4' · '3.2 - 3.3' · '3.4 - 3.5' · '3.6 - 3.7' · '3.2 - 3.3' ·
'3.2 - 3.3' · '3.0 - 3.1' · '3.1 - 3.2' · '3.5 - 3.6' · '3.4 - 3.5' · '3.4 - 3.5' · '3.3 - 3.4' · '3.6 - 3.7' · '3.1 - 3.2' · '3.6 - 3.7' ·
'3.4 - 3.5' · '3.2 - 3.3' · '3.3 - 3.4' · '3.8 - 3.9' · '3.3 - 3.4' · '3.1 - 3.2' · '3.9 - 4.0' · '3.2 - 3.3' · '3.3 - 3.4' · '3.5 - 3.6' ·
'3.8 - 3.9' · '3.1 - 3.2' · '3.3 - 3.4' · '3.5 - 3.6' · '3.4 - 3.5' · '3.7 - 3.8' · '3.5 - 3.6' · '3.0 - 3.1' · '3.5 - 3.6' · '3.7 - 3.8' ·
'3.9 - 4.0' · '3.4 - 3.5' · '3.3 - 3.4' · '3.9 - 4.0' · '3.4 - 3.5' · '3.1 - 3.2' · '3.3 - 3.4' · '3.2 - 3.3' · '3.1 - 3.2' · '3.0 - 3.1' ·
'3.2 - 3.3' · '3.5 - 3.6' · '3.6 - 3.7' · '3.1 - 3.2' · '3.8 - 3.9' · '3.2 - 3.3' · '3.2 - 3.3' · '3.9 - 4.0' · '3.3 - 3.4' · '3.2 - 3.3'

3	3.002	3.003	3.006	3.008	3.009	3.011	3.012	3.014	3.015	3.016	3.017	3.018	
9	2	2	1	3	4	2	1	1	1	1	1	3	2
3.019	3.02	3.021	3.022	3.023	3.024	3.025	3.026	3.028	3.029	3.03	3.031	3.032	
1	1	1	4	5	3	1	2	1	1	2	1	2	
3.033	3.034	3.035	3.036	3.037	3.039	3.04	3.043	3.044	3.045	3.046	3.047	3.048	
3	2	4	2	2	3	2	5	2	1	1	1	1	
3.049	3.05	3.051	3.052	3.053	3.054	3.055	3.056	3.058	3.059	3.06	3.061	3.062	
4	1	1	2	2	1	1	5	2	2	1	2	3	
3.063	3.064	3.068	3.069	3.07	3.071	3.073	3.074	3.075	3.076	3.077	3.078	3.079	
2	4	1	4	3	3	2	3	1	2	2	2	4	
3.081	3.082	3.083	3.085	3.086	3.087	3.088	3.089	3.09	3.091	3.093	3.094	3.097	
1	1	2	1	4	2	1	3	1	1	3	2	4	
3.098	3.1	3.101	3.103	3.104	3.105	3.107	3.108	3.109	3.11	3.111	3.113	3.114	
1	9	1	2	1	2	1	2	2	1	1	2	2	
3.116	3.117	3.118	3.119	3.123	3.124	3.125	3.127	3.128	3.13	3.132	3.133	3.136	
1	2	2	2	1	2	2	3	1	2	1	2	2	
3.137	3.138	3.14	3.141	3.142	3.143	3.144	3.145	3.146	3.147	3.148	3.149	3.15	
1	2	3	2	1	1	2	4	2	2	2	3	3	
3.152	3.154	3.155	3.157	3.16	3.162	3.164	3.165	3.167	3.168	3.169	3.17	3.171	
1	3	2	2	2	2	1	1	1	3	2	4	1	
3.173	3.174	3.175	3.177	3.178	3.179	3.181	3.183	3.184	3.186	3.188	3.189	3.19	
1	1	1	3	1	2	1	2	1	2	3	2	2	
3.191	3.192	3.193	3.195	3.196	3.197	3.198	3.2	3.202	3.203	3.204	3.207	3.208	
1	3	4	1	2	1	1	6	2	3	3	2	4	
3.209	3.21	3.211	3.212	3.213	3.214	3.215	3.216	3.217	3.218	3.221	3.222	3.223	
2	2	1	1	2	1	3	1	1	4	1	3	4	
3.226	3.227	3.23	3.231	3.233	3.234	3.236	3.237	3.238	3.239	3.242	3.243	3.244	
1	2	2	1	4	1	2	2	2	3	2	1	1	
3.245	3.247	3.248	3.25	3.253	3.254	3.255	3.256	3.257	3.259	3.26	3.262	3.263	
2	1	2	1	3	4	2	1	2	2	1	1	1	

3.269	3.271	3.272	3.274	3.275	3.276	3.277	3.278	3.279	3.282	3.283	3.284	3.288
1	2	1	1	2	1	2	4	1	1	2	4	1
3.289	3.29	3.292	3.293	3.294	3.296	3.297	3.298	3.3	3.302	3.303	3.304	3.305
1	1	2	2	1	1	1	1	5	1	1	1	1
3.306	3.307	3.309	3.311	3.313	3.314	3.315	3.317	3.321	3.323	3.326	3.329	3.33
1	1	1	2	3	1	2	1	2	1	1	1	1
3.331	3.333	3.335	3.336	3.337	3.338	3.339	3.34	3.341	3.342	3.344	3.346	3.347
1	1	1	1	1	2	2	3	1	2	3	1	2
3.348	3.35	3.351	3.354	3.356	3.357	3.359	3.36	3.362	3.363	3.364	3.367	3.368
4	2	1	1	2	1	2	1	2	1	2	2	1
3.369	3.37	3.371	3.373	3.374	3.376	3.379	3.38	3.384	3.385	3.386	3.388	3.389
1	3	2	1	3	2	2	2	2	1	1	1	2
3.39	3.392	3.393	3.394	3.395	3.396	3.398	3.4	3.403	3.404	3.405	3.406	3.407
1	1	2	1	1	1	2	6	3	3	3	1	2
3.408	3.41	3.411	3.412	3.413	3.414	3.415	3.417	3.418	3.421	3.423	3.424	3.426
1	1	1	1	1	1	3	1	1	1	1	2	2
3.427	3.428	3.429	3.43	3.432	3.433	3.434	3.435	3.436	3.437	3.44	3.441	3.442
2	1	2	2	2	3	1	1	1	1	1	2	1
3.443	3.445	3.448	3.45	3.451	3.452	3.458	3.462	3.464	3.465	3.466	3.467	3.469
1	1	1	2	1	1	1	1	1	1	1	1	1
3.47	3.473	3.474	3.475	3.476	3.478	3.479	3.481	3.483	3.485	3.486	3.489	3.492
2	1	3	1	2	4	2	3	1	2	1	1	1
3.493	3.494	3.495	3.496	3.498	3.5	3.503	3.507	3.51	3.511	3.512	3.514	3.515
2	1	1	2	1	4	1	1	2	1	3	1	1
3.516	3.517	3.518	3.519	3.52	3.524	3.526	3.527	3.529	3.531	3.532	3.533	3.534
1	2	1	1	1	1	2	1	1	1	2	3	1
3.537	3.54	3.541	3.543	3.548	3.55	3.552	3.554	3.555	3.556	3.558	3.559	3.56
1	2	2	1	2	2	1	2	1	1	1	3	1
3.563	3.573	3.575	3.576	3.577	3.579	3.581	3.583	3.586	3.589	3.59	3.593	3.596
1	1	1	3	3	1	2	1	1	1	1	3	1
3.597	3.6	3.602	3.603	3.605	3.606	3.607	3.608	3.611	3.612	3.613	3.614	3.618

2	1	1	3	2	1	5	2	1	1	2	1	1
3.623	3.626	3.627	3.63	3.632	3.633	3.636	3.637	3.642	3.644	3.647	3.649	3.65
1	1	1	1	1	1	1	1	2	2	1	1	1
3.656	3.658	3.659	3.663	3.666	3.667	3.668	3.671	3.676	3.681	3.682	3.683	3.685
3	1	1	2	1	1	1	1	1	2	1	2	1
3.687	3.689	3.69	3.693	3.696	3.697	3.7	3.702	3.703	3.704	3.707	3.715	3.716
1	1	2	1	3	1	2	1	2	1	2	4	1
3.717	3.721	3.722	3.723	3.724	3.729	3.73	3.733	3.734	3.738	3.739	3.741	3.748
1	1	1	1	2	1	2	1	2	1	1	1	2
3.749	3.755	3.756	3.762	3.766	3.767	3.768	3.77	3.776	3.778	3.781	3.782	3.783
1	1	1	1	1	3	1	1	1	1	2	1	1
3.788	3.792	3.805	3.806	3.807	3.811	3.815	3.818	3.819	3.82	3.824	3.825	3.829
1	1	1	1	1	2	1	1	2	1	1	1	1
3.833	3.835	3.837	3.838	3.839	3.84	3.841	3.844	3.847	3.85	3.852	3.856	3.861
1	1	1	1	2	1	1	2	1	2	1	1	1
3.871	3.878	3.879	3.882	3.888	3.889	3.896	3.897	3.898	3.9	3.903	3.906	3.91
1	2	2	1	1	2	1	2	1	2	1	1	1
3.911	3.914	3.916	3.92	3.928	3.931	3.936	3.947	3.948	3.954	3.956	3.957	3.959
1	1	1	1	2	1	1	1	1	1	1	1	1
3.96	3.961	3.967	3.969	3.97	4							
2	1	2	2	2	14							

Plots

In [6]:

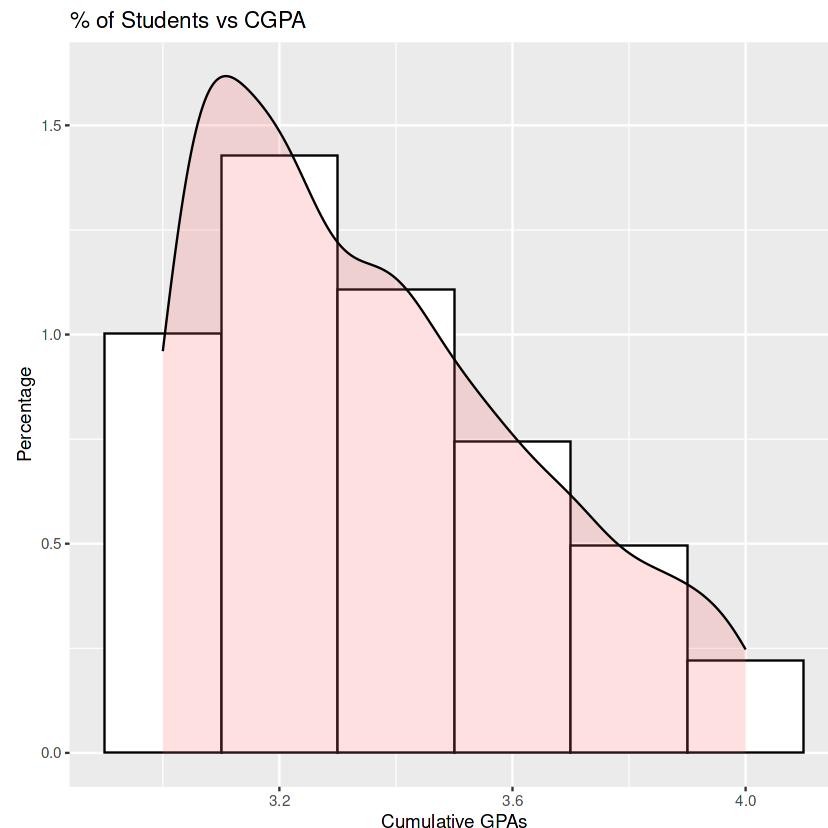
```
# Plot for combined student data

ggplot(allStud, aes(x = `Cumulative GPA`)) +
  geom_histogram(aes(y = ..density..),           # y axis as density
                 binwidth = 0.2,
                 color="black", fill="white") +
  geom_density(alpha = 0.2, fill = "#FF6666") +
  xlab("Cumulative GPAs") +
  ylab("Percentage") +
  ggtitle("% of Students vs CGPA")
```

Warning message:

"The dot-dot notation (`..density..`) was deprecated in ggplot2 3.4.0.

i Please use `after_stat(density)` instead."



Method 1

In [7]:

```
gpa <- allStud$'Cumulative GPA'

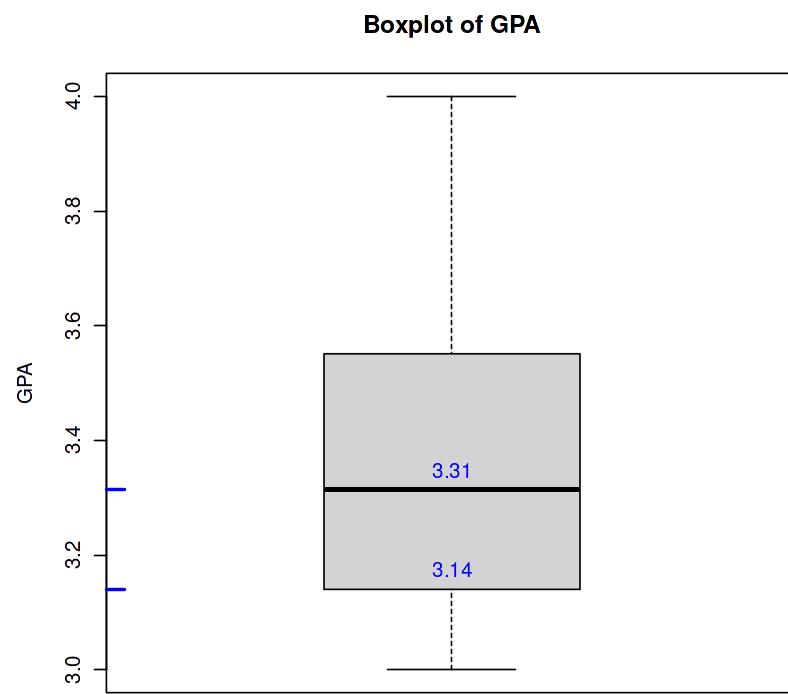
boxplot(gpa, main = "Boxplot of GPA", ylab = "GPA")

percentile_values <- quantile(gpa, probs = c(0.25,0.50)) #quantile
percentile_values

# Box Plot Quantile Marking
rug(percentile_values,side=2,col="blue",lwd=2)

# Box Plot Quantile Values
text(x = c(1, 1), y = percentile_values, labels = round(percentile_values, 2), pos = 3, col = 'blue')
```

25%: 3.14 50%: 3.314



In [8]:

```
#####
# Method 1 Analysis #
#####

# Original Condition: Cumulative GPA >= 3.0

allStud$row_count <- 1

# Goal 1 - 25%: 681
filtered_df <- allStud[allStud$'Cumulative GPA' > 3.14, ]
filtered_df
sum(filtered_df$row_count) # Result: 679

# Goal 2 - 50%: 454
filtered_df <- allStud[allStud$'Cumulative GPA' > 3.3135, ]
filtered_df
sum(filtered_df$row_count) # Result: 454
```

A tibble: 679 × 11

Cumulative GPA	ECON 2010	ECON 2020	MATH 1112	MATH 2510	Stats Course not MATH 2510	BCOR 1015		Stats Course not 2510	Category	row_count
<dbl>	<chr>	<chr>	<chr>	<chr>	<chr>	<chr>	<chr>	<chr>	<chr>	<dbl>
3.223	B	A	B	B	NA	NA	NA	NA	3.2 - 3.3	1
3.237	B+	A	B	B	NA	NA	NA	NA	3.2 - 3.3	1
3.150	B	B	B	B-	NA	NA	NA	NA	3.1 - 3.2	1
3.237	B	B	B-	A-	BCOR 1025	A-	NA	NA	3.2 - 3.3	1
3.188	A	A-	B-	B-	BCOR 1025	NA	NA	NA	3.1 - 3.2	1
3.920	A-	A-	A	A	BCOR 1025	NA	NA	NA	3.9 - 4.0	1
3.348	B	A	B+	B	NA	NA	NA	NA	3.3 - 3.4	1
3.626	A	A	A	A	NA	NA	NA	NA	3.6 - 3.7	1
3.404	B+	A-	B+	B+	SOCY 2061	NA	NA	NA	3.4 - 3.5	1
3.259	B-	A	B+	B-	NA	NA	NA	NA	3.2 - 3.3	1
3.233	A-	B+	B-	B	SOCY 2061	NA	NA	NA	3.2 - 3.3	1
3.600	A-	B	A	A-	NA	NA	NA	NA	3.6 - 3.7	1
3.630	A-	A	A	A-	SOCY 2061	NA	NA	NA	3.6 - 3.7	1
3.724	B	A-	A	A	PSCI 2075	NA	NA	NA	3.7 - 3.8	1
3.242	B-	A-	B	B+	SOCY 2061	NA	NA	NA	3.2 - 3.3	1
3.481	B-	A	B+	A	NA	NA	NA	NA	3.4 - 3.5	1
3.337	B-	A	B+	B+	NA	NA	NA	NA	3.3 - 3.4	1
3.611	A-	A	A-	A	NA	NA	NA	NA	3.6 - 3.7	1
3.554	B+	B+	A-	A	NA	NA	NA	NA	3.5 - 3.6	1
3.729	A-	A-	A-	A	PSYC 2111	A-	NA	NA	3.7 - 3.8	1
3.208	B	A	A-	B-	NA	NA	NA	NA	3.2 - 3.3	1
3.250	AP	AP	A-	B-	NA	NA	NA	NA	3.2 - 3.3	1
4.000	A+	A+	A+	A+	NA	NA	NA	NA	3.9 - 4.0	1
3.715	B	B+	A	A-	PSCI 2075	NA	NA	NA	3.7 - 3.8	1
3.218	B+	B+	B-	B+	SOCY 2061	NA	NA	NA	3.2 - 3.3	1

Cumulative GPA	ECON 2010	ECON 2020	MATH 1112	MATH 2510	Stats Course not MATH 2510	BCOR 1015	Stats	Stats Course not 2510	Category	row_count
<dbl>	<chr>	<chr>	<chr>	<chr>	<chr>	<chr>	<chr>	<chr>	<chr>	<dbl>
3.748	B	B+	A	A	NA	NA	NA	NA	3.7 - 3.8	1
3.607	B	A	A-	A-	SOCY 2061	NA	NA	NA	3.6 - 3.7	1
3.663	B	A	A	A	NA	NA	NA	NA	3.6 - 3.7	1
3.247	B	A	B	B	SOCY 2061	NA	NA	NA	3.2 - 3.3	1
3.486	B+	A-	B+	B	NA	NA	NA	NA	3.4 - 3.5	1
:	:	:	:	:	:	:	:	:	:	:
3.277	A	B+	B+	A-	NA	NA	NA	NA	3.2 - 3.3	1
3.398	A	A	A	A	NA	NA	NA	NA	3.3 - 3.4	1
3.533	A	B+	A	B+	NA	NA	NA	NA	3.5 - 3.6	1
3.844	A	B	A	A	NA	NA	NA	NA	3.8 - 3.9	1
3.195	B	A	A	B	NA	NA	NA	SOCY 2061	3.1 - 3.2	1
3.344	B	A-	B	B+	NA	NA	NA	PSCI 2075	3.3 - 3.4	1
3.532	A-	A	A	B-	NA	NA	NA	NA	3.5 - 3.6	1
3.424	B	B	B+	B+	NA	NA	NA	NA	3.4 - 3.5	1
3.703	B+	A	B	A	NA	A	NA	NA	3.7 - 3.8	1
3.576	A	A	A-	B	NA	NA	NA	NA	3.5 - 3.6	1
3.526	A-	A	A	B+	NA	NA	NA	NA	3.5 - 3.6	1
3.700	A	A-	A	A	NA	NA	NA	NA	3.7 - 3.8	1
3.954	A	A	A	A	NA	NA	NA	NA	3.9 - 4.0	1
3.485	B+	A	A	B	NA	NA	NA	INFO 1301	3.4 - 3.5	1
3.321	A	A	A	A	NA	NA	NA	SOCY 2061	3.3 - 3.4	1
3.961	A	A	A	A	NA	A-	NA	NA	3.9 - 4.0	1
3.492	B	A	A	A	NA	NA	NA	NA	3.4 - 3.5	1
3.356	A	B+	B	A-	NA	NA	NA	SOCY 2061	3.3 - 3.4	1
3.245	A	A	B+	B	NA	NA	NA	NA	3.2 - 3.3	1
3.169	B	B	B	A	NA	NA	NA	NA	3.1 - 3.2	1
3.255	A-	B+	A	B+	NA	NA	NA	NA	3.2 - 3.3	1
3.514	B-	A-	A	B	NA	NA	NA	NA	3.5 - 3.6	1

Cumulative GPA	ECON 2010	ECON 2020	MATH 1112	MATH 2510	Stats Course not MATH 2510	BCOR 1015	Stats	Stats Course not 2510	Category	row_count
<dbl>	<chr>	<chr>	<chr>	<chr>	<chr>	<chr>	<chr>	<chr>	<chr>	<dbl>
3.644	A-	A-	A	A	NA	NA	NA	PSCI 2075	3.6 - 3.7	1
3.149	B-	B+	A	A	NA	NA	NA	NA	3.1 - 3.2	1
3.897	A	A	A	B+	NA	NA	NA	NA	3.8 - 3.9	1
3.297	A	A-	B-	B+	NA	NA	NA	SOCY 2061	3.2 - 3.3	1
3.278	B-	B+	B+	A-	NA	NA	NA	NA	3.2 - 3.3	1
3.959	A	A	A	A	NA	NA	NA	NA	3.9 - 4.0	1
3.303	B	A	B	B+	NA	NA	NA	NA	3.3 - 3.4	1
3.202	B	A	B	A	NA	NA	NA	NA	3.2 - 3.3	1

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A tibble: 454 × 11

Cumulative GPA	ECON 2010	ECON 2020	MATH 1112	MATH 2510	Stats Course not MATH 2510	BCOR 1015		Stats Course not 2510	Category	row_count
<dbl>	<chr>	<chr>	<chr>	<chr>	<chr>	<chr>	<chr>	<chr>	<chr>	<dbl>
3.920	A-	A-	A	A	BCOR 1025	NA	NA	NA	3.9 - 4.0	1
3.348	B	A	B+	B	NA	NA	NA	NA	3.3 - 3.4	1
3.626	A	A	A	A	NA	NA	NA	NA	3.6 - 3.7	1
3.404	B+	A-	B+	B+	SOCY 2061	NA	NA	NA	3.4 - 3.5	1
3.600	A-	B	A	A-	NA	NA	NA	NA	3.6 - 3.7	1
3.630	A-	A	A	A-	SOCY 2061	NA	NA	NA	3.6 - 3.7	1
3.724	B	A-	A	A	PSCI 2075	NA	NA	NA	3.7 - 3.8	1
3.481	B-	A	B+	A	NA	NA	NA	NA	3.4 - 3.5	1
3.337	B-	A	B+	B+	NA	NA	NA	NA	3.3 - 3.4	1
3.611	A-	A	A-	A	NA	NA	NA	NA	3.6 - 3.7	1
3.554	B+	B+	A-	A	NA	NA	NA	NA	3.5 - 3.6	1
3.729	A-	A-	A-	A	PSYC 2111	A-	NA	NA	3.7 - 3.8	1
4.000	A+	A+	A+	A+	NA	NA	NA	NA	3.9 - 4.0	1
3.715	B	B+	A	A-	PSCI 2075	NA	NA	NA	3.7 - 3.8	1
3.748	B	B+	A	A	NA	NA	NA	NA	3.7 - 3.8	1
3.607	B	A	A-	A-	SOCY 2061	NA	NA	NA	3.6 - 3.7	1
3.663	B	A	A	A	NA	NA	NA	NA	3.6 - 3.7	1
3.486	B+	A-	B+	B	NA	NA	NA	NA	3.4 - 3.5	1
3.696	B-	A	A	B	NA	NA	NA	NA	3.6 - 3.7	1
3.607	B-	A-	A-	B	NA	NA	NA	NA	3.6 - 3.7	1
3.400	B+	A-	A-	B	NA	NA	NA	NA	3.4 - 3.5	1
3.512	B+	A-	B-	B+	NA	NA	NA	NA	3.5 - 3.6	1
3.552	B	A	A	B+	NA	NA	NA	NA	3.5 - 3.6	1
3.373	B	B	A	B+	SOCY 2061	NA	NA	NA	3.3 - 3.4	1
3.606	B	B+	A	A-	NA	NA	NA	NA	3.6 - 3.7	1

Cumulative GPA	ECON 2010	ECON 2020	MATH 1112	MATH 2510	Stats Course not MATH 2510	BCOR 1015	Stats	Stats Course not 2510	Category	row_count
<dbl>	<chr>	<chr>	<chr>	<chr>	<chr>	<chr>	<chr>	<chr>	<chr>	<dbl>
3.840	A-	A	A	A	NA	NA	NA	NA	3.8 - 3.9	1
3.474	B	B	A-	A	SOCY 2061	NA	NA	NA	3.4 - 3.5	1
3.500	B+	B+	B	B+	NA	NA	NA	NA	3.5 - 3.6	1
3.690	AP	AP	A	A-	PSCI 2075	NA	NA	NA	3.6 - 3.7	1
3.428	B-	A-	A	A-	NA	NA	NA	NA	3.4 - 3.5	1
:	:	:	:	:	:	:	:	:	:	:
3.548	B	B	B	B	NA	NA	NA	NA	3.5 - 3.6	1
3.424	B	A	A-	B	NA	NA	NA	NA	3.4 - 3.5	1
3.418	A	A-	B+	A	NA	NA	NA	NA	3.4 - 3.5	1
3.314	B-	A	A	A	NA	NA	NA	SOCY 2061	3.3 - 3.4	1
3.642	B	B	A-	A	NA	NA	NA	NA	3.6 - 3.7	1
3.642	A	A	A	A	NA	NA	NA	NA	3.6 - 3.7	1
3.496	A	A	A-	A	NA	NA	NA	NA	3.4 - 3.5	1
3.882	A	B+	A	A	NA	NA	NA	NA	3.8 - 3.9	1
3.340	B+	A	A-	B+	NA	NA	NA	NA	3.3 - 3.4	1
4.000	A+	A	A+	A	NA	NA	NA	PSCI 2075	3.9 - 4.0	1
3.398	A	A	A	A	NA	NA	NA	NA	3.3 - 3.4	1
3.533	A	B+	A	B+	NA	NA	NA	NA	3.5 - 3.6	1
3.844	A	B	A	A	NA	NA	NA	NA	3.8 - 3.9	1
3.344	B	A-	B	B+	NA	NA	NA	PSCI 2075	3.3 - 3.4	1
3.532	A-	A	A	B-	NA	NA	NA	NA	3.5 - 3.6	1
3.424	B	B	B+	B+	NA	NA	NA	NA	3.4 - 3.5	1
3.703	B+	A	B	A	NA	A	NA	NA	3.7 - 3.8	1
3.576	A	A	A-	B	NA	NA	NA	NA	3.5 - 3.6	1
3.526	A-	A	A	B+	NA	NA	NA	NA	3.5 - 3.6	1
3.700	A	A-	A	A	NA	NA	NA	NA	3.7 - 3.8	1
3.954	A	A	A	A	NA	NA	NA	NA	3.9 - 4.0	1
3.485	B+	A	A	B	NA	NA	NA	INFO 1301	3.4 - 3.5	1

Cumulative GPA	ECON 2010	ECON 2020	MATH 1112	MATH 2510	Stats Course not MATH 2510	BCOR 1015	Stats	Stats Course not 2510	Category	row_count
<dbl>	<chr>	<chr>	<chr>	<chr>	<chr>	<chr>	<chr>	<chr>	<chr>	<dbl>
3.321	A	A	A	A	NA	NA	NA	SOCY 2061	3.3 - 3.4	1
3.961	A	A	A	A	NA	A-	NA	NA	3.9 - 4.0	1
3.492	B	A	A	A	NA	NA	NA	NA	3.4 - 3.5	1
3.356	A	B+	B	A-	NA	NA	NA	SOCY 2061	3.3 - 3.4	1
3.514	B-	A-	A	B	NA	NA	NA	NA	3.5 - 3.6	1
3.644	A-	A-	A	A	NA	NA	NA	PSCI 2075	3.6 - 3.7	1
3.897	A	A	A	B+	NA	NA	NA	NA	3.8 - 3.9	1
3.959	A	A	A	A	NA	NA	NA	NA	3.9 - 4.0	1

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Method 2

In [9]:

```
# Student Subject/Grades vs Count

df <- data.frame(
  Group = c('A+', 'A+', 'A+', 'A+', 'A', 'A', 'A', 'A', 'A-', 'A-', 'A-', 'A-', 'B+', 'B+', 'B+', 'B+', 'B', 'B', 'B', 'B', 'B-', 'B-', 'B-', 'B-', 'AP', 'AP', 'AP', 'AP'),
  Subgroup = c(names(allStud)[2], names(allStud)[3], names(allStud)[4], 'STATS'),
  Value = c(length(allStud$'ECON 2010'[allStud$'ECON 2010' == 'A+']),
            length(allStud$'ECON 2020'[allStud$'ECON 2020' == 'A+']),
            length(allStud$'MATH 1112'[allStud$'MATH 1112' == 'A+']),
            length(allStud$'MATH 2510'[allStud$'MATH 2510' == 'A+']),
            length(allStud$'ECON 2010'[allStud$'ECON 2010' == 'A']),
            length(allStud$'ECON 2020'[allStud$'ECON 2020' == 'A']),
            length(allStud$'MATH 1112'[allStud$'MATH 1112' == 'A']),
            length(allStud$'MATH 2510'[allStud$'MATH 2510' == 'A']),
            length(allStud$'ECON 2010'[allStud$'ECON 2010' == 'A-']),
            length(allStud$'ECON 2020'[allStud$'ECON 2020' == 'A-']),
            length(allStud$'MATH 1112'[allStud$'MATH 1112' == 'A-']),
            length(allStud$'MATH 2510'[allStud$'MATH 2510' == 'A-']),
            length(allStud$'ECON 2010'[allStud$'ECON 2010' == 'B+']),
            length(allStud$'ECON 2020'[allStud$'ECON 2020' == 'B+']),
            length(allStud$'MATH 1112'[allStud$'MATH 1112' == 'B+']),
            length(allStud$'MATH 2510'[allStud$'MATH 2510' == 'B+']),
            length(allStud$'ECON 2010'[allStud$'ECON 2010' == 'B']))
```

```
length(allStud$'ECON 2020'[allStud$'ECON 2020' == 'B']),  
length(allStud$'MATH 1112'[allStud$'MATH 1112' == 'B']),  
length(allStud$'MATH 2510'[allStud$'MATH 2510' == 'B']),  
  
length(allStud$'ECON 2010'[allStud$'ECON 2010' == 'B-']),  
length(allStud$'ECON 2020'[allStud$'ECON 2020' == 'B-']),  
length(allStud$'MATH 1112'[allStud$'MATH 1112' == 'B-']),  
length(allStud$'MATH 2510'[allStud$'MATH 2510' == 'B-']),  
  
length(allStud$'ECON 2010'[allStud$'ECON 2010' == 'AP']),  
length(allStud$'ECON 2020'[allStud$'ECON 2020' == 'AP']),  
length(allStud$'MATH 1112'[allStud$'MATH 1112' == 'AP']),  
length(allStud$'MATH 2510'[allStud$'MATH 2510' == 'AP']))  
)  
  
# If we set to B+ it will reduce the admits by 438 students (~50%)  
length(allStud$'ECON 2010'[allStud$'ECON 2010' == 'B'])  
length(allStud$'ECON 2010'[allStud$'ECON 2010' == 'B-'])  
  
length(allStud$'ECON 2020'[allStud$'ECON 2020' == 'B'])  
length(allStud$'ECON 2020'[allStud$'ECON 2020' == 'B-'])  
  
# If we set to B+ it will reduce the admits by 290 students (~25%)  
length(allStud$'MATH 1112'[allStud$'MATH 1112' == 'B'])  
length(allStud$'MATH 1112'[allStud$'MATH 1112' == 'B-'])  
  
length(allStud$'MATH 2510'[allStud$'MATH 2510' == 'B'])  
length(allStud$'MATH 2510'[allStud$'MATH 2510' == 'B-'])
```

```
ggplot(df, aes(x=Subgroup, y= Value, fill= Group )) +  
  geom_bar(stat="identity", position="dodge") +  
  scale_fill_manual(values=c("darkgreen", "red", "orange", 'purple', 'lightblue', 'violet', 'maroon'))  
+  
  labs(title="Subject/ Student Grades vs Count",  
       x = "Subjects",  
       y = "Count") +  
  theme(legend.position="top")
```

273

164

235

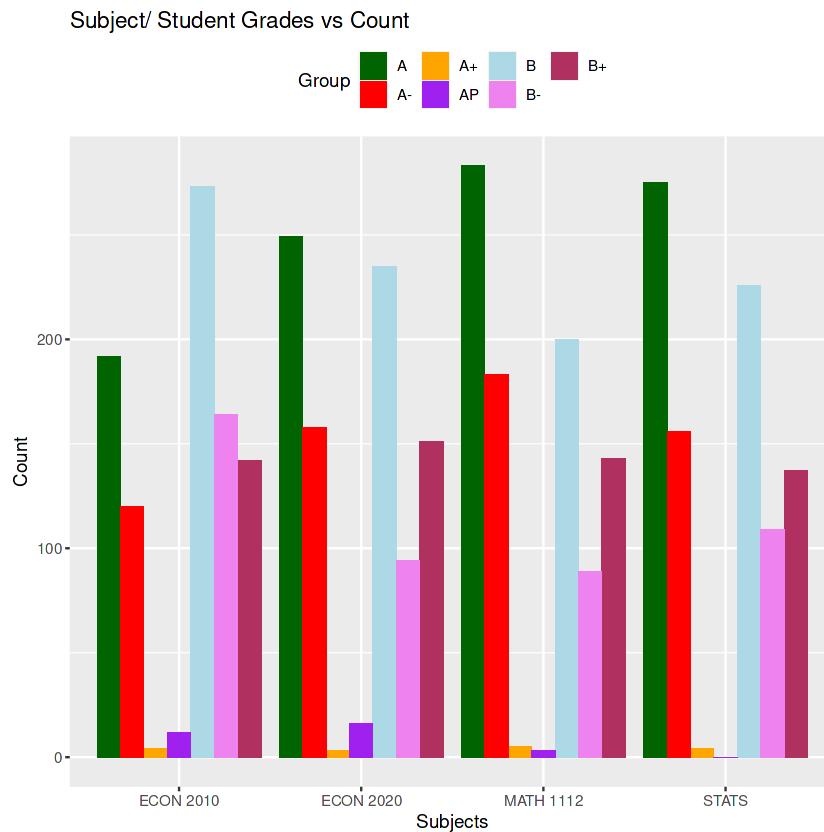
94

200

89

226

109



In [10]:

```
#####
# Method 2 Analysis ##
#####

# Original Condition: Each Course >= B-

allStud$`ECON 2010` <- as.character(allStud$`ECON 2010`)
allStud$`ECON 2020` <- as.character(allStud$`ECON 2020`)
allStud$`MATH 1112` <- as.character(allStud$`MATH 1112`)
allStud$`MATH 2510` <- as.character(allStud$`MATH 2510`)

allStud$row_count <- 1
aggregated_data <- aggregate(row_count ~ `ECON 2010` + `ECON 2020` + `MATH 1112` + `MATH 2510`, FUN = length, data = allStud)

sum(aggregated_data$row_count) # Result: 907

# Goal:25%: 681
# Condition: ECON 2010 >= B, ECON 2020 >= B

filtered_df <- aggregated_data %>%
  filter(`ECON 2010` %in% c("B", "B+", "A-", "A", "A+", "AP") &
         `ECON 2020` %in% c("B", "B+", "A-", "A", "A+", "AP") &
         `MATH 1112` %in% c("B-", "B", "B+", "A-", "A", "A+", "AP") &
         `MATH 2510` %in% c("B-", "B", "B+", "A-", "A", "A+", "AP"))

sum(filtered_df$row_count) # Result: 677

# Goal 50%: 454
# Condition: MATH 1112 >= B+, Other Courses >= B,
```

```
filtered_df <- aggregated_data %>%  
  filter(`ECON 2010` %in% c("B", "B+", "A-", "A", "A+", "AP") &  
        `ECON 2020` %in% c("B", "B+", "A-", "A", "A+", "AP") &  
        `MATH 1112` %in% c("B+", "A-", "A", "A+", "AP") &  
        `MATH 2510` %in% c("B", "B+", "A-", "A", "A+", "AP"))  
  
sum(filtered_df$row_count) # Result:448
```

907

677

448

Method 3

In [11]:

```
# Subject/ CGPA Range/ Student Grades vs Count

## ECON 2010

df <- data.frame(
  Group = c('A+', 'A+', 'A-', 'B+', 'B-', 'AP', 'AP'),
  Subgroup = c(unique(allStud$Category)[2],
               unique(allStud$Category)[3],
               unique(allStud$Category)[1],
               unique(allStud$Category)[5],
               unique(allStud$Category)[7],
               unique(allStud$Category)[9],
               unique(allStud$Category)[6],
               unique(allStud$Category)[8],
               unique(allStud$Category)[10],
               unique(allStud$Category)[4]),
  Value = c(length(allStud$Category[allStud$Category == '3.0 - 3.1' & allStud$'ECON 2010' == 'A+']),
            length(allStud$Category[allStud$Category == '3.1 - 3.2' & allStud$'ECON 2010' == 'A+']),
            length(allStud$Category[allStud$Category == '3.2 - 3.3' & allStud$'ECON 2010' == 'A+']),
            length(allStud$Category[allStud$Category == '3.3 - 3.4' & allStud$'ECON 2010' == 'A+']),
            length(allStud$Category[allStud$Category == '3.4 - 3.5' & allStud$'ECON 2010' == 'A+']))
```

```
length(allStud$Category[allStud$Category == '3.5 - 3.6' & allStud$'ECON 2010' == 'A+']),  
length(allStud$Category[allStud$Category == '3.6 - 3.7' & allStud$'ECON 2010' == 'A+']),  
length(allStud$Category[allStud$Category == '3.7 - 3.8' & allStud$'ECON 2010' == 'A+']),  
length(allStud$Category[allStud$Category == '3.8 - 3.9' & allStud$'ECON 2010' == 'A+']),  
length(allStud$Category[allStud$Category == '3.9 - 4.0' & allStud$'ECON 2010' == 'A+']),  
  
length(allStud$Category[allStud$Category == '3.0 - 3.1' & allStud$'ECON 2010' == 'A']),  
length(allStud$Category[allStud$Category == '3.1 - 3.2' & allStud$'ECON 2010' == 'A']),  
length(allStud$Category[allStud$Category == '3.2 - 3.3' & allStud$'ECON 2010' == 'A']),  
length(allStud$Category[allStud$Category == '3.3 - 3.4' & allStud$'ECON 2010' == 'A']),  
length(allStud$Category[allStud$Category == '3.4 - 3.5' & allStud$'ECON 2010' == 'A']),  
length(allStud$Category[allStud$Category == '3.5 - 3.6' & allStud$'ECON 2010' == 'A']),  
length(allStud$Category[allStud$Category == '3.6 - 3.7' & allStud$'ECON 2010' == 'A']),  
length(allStud$Category[allStud$Category == '3.7 - 3.8' & allStud$'ECON 2010' == 'A']),  
length(allStud$Category[allStud$Category == '3.8 - 3.9' & allStud$'ECON 2010' == 'A']),  
length(allStud$Category[allStud$Category == '3.9 - 4.0' & allStud$'ECON 2010' == 'A']),  
  
length(allStud$Category[allStud$Category == '3.0 - 3.1' & allStud$'ECON 2010' == 'A-']),  
length(allStud$Category[allStud$Category == '3.1 - 3.2' & allStud$'ECON 2010' == 'A-']),  
length(allStud$Category[allStud$Category == '3.2 - 3.3' & allStud$'ECON 2010' == 'A-']),  
length(allStud$Category[allStud$Category == '3.3 - 3.4' & allStud$'ECON 2010' == 'A-']),  
length(allStud$Category[allStud$Category == '3.4 - 3.5' & allStud$'ECON 2010' == 'A-']),  
length(allStud$Category[allStud$Category == '3.5 - 3.6' & allStud$'ECON 2010' == 'A-']),  
length(allStud$Category[allStud$Category == '3.6 - 3.7' & allStud$'ECON 2010' == 'A-']),  
length(allStud$Category[allStud$Category == '3.7 - 3.8' & allStud$'ECON 2010' == 'A-']),  
length(allStud$Category[allStud$Category == '3.8 - 3.9' & allStud$'ECON 2010' == 'A-']),  
length(allStud$Category[allStud$Category == '3.9 - 4.0' & allStud$'ECON 2010' == 'A-']),  
  
length(allStud$Category[allStud$Category == '3.0 - 3.1' & allStud$'ECON 2010' == 'B+']),  
length(allStud$Category[allStud$Category == '3.1 - 3.2' & allStud$'ECON 2010' == 'B+']),  
length(allStud$Category[allStud$Category == '3.2 - 3.3' & allStud$'ECON 2010' == 'B+'])
```

```
length(allStud$Category[allStud$Category == '3.3 - 3.4' & allStud$'ECON 2010' == 'B+']),  
length(allStud$Category[allStud$Category == '3.4 - 3.5' & allStud$'ECON 2010' == 'B+']),  
length(allStud$Category[allStud$Category == '3.5 - 3.6' & allStud$'ECON 2010' == 'B+']),  
length(allStud$Category[allStud$Category == '3.6 - 3.7' & allStud$'ECON 2010' == 'B+']),  
length(allStud$Category[allStud$Category == '3.7 - 3.8' & allStud$'ECON 2010' == 'B+']),  
length(allStud$Category[allStud$Category == '3.8 - 3.9' & allStud$'ECON 2010' == 'B+']),  
length(allStud$Category[allStud$Category == '3.9 - 4.0' & allStud$'ECON 2010' == 'B+']),  
  
length(allStud$Category[allStud$Category == '3.0 - 3.1' & allStud$'ECON 2010' == 'B']),  
length(allStud$Category[allStud$Category == '3.1 - 3.2' & allStud$'ECON 2010' == 'B']),  
length(allStud$Category[allStud$Category == '3.2 - 3.3' & allStud$'ECON 2010' == 'B']),  
length(allStud$Category[allStud$Category == '3.3 - 3.4' & allStud$'ECON 2010' == 'B']),  
length(allStud$Category[allStud$Category == '3.4 - 3.5' & allStud$'ECON 2010' == 'B']),  
length(allStud$Category[allStud$Category == '3.5 - 3.6' & allStud$'ECON 2010' == 'B']),  
length(allStud$Category[allStud$Category == '3.6 - 3.7' & allStud$'ECON 2010' == 'B']),  
length(allStud$Category[allStud$Category == '3.7 - 3.8' & allStud$'ECON 2010' == 'B']),  
length(allStud$Category[allStud$Category == '3.8 - 3.9' & allStud$'ECON 2010' == 'B']),  
length(allStud$Category[allStud$Category == '3.9 - 4.0' & allStud$'ECON 2010' == 'B']),  
  
length(allStud$Category[allStud$Category == '3.0 - 3.1' & allStud$'ECON 2010' == 'B-']),  
length(allStud$Category[allStud$Category == '3.1 - 3.2' & allStud$'ECON 2010' == 'B-']),  
length(allStud$Category[allStud$Category == '3.2 - 3.3' & allStud$'ECON 2010' == 'B-']),  
length(allStud$Category[allStud$Category == '3.3 - 3.4' & allStud$'ECON 2010' == 'B-']),  
length(allStud$Category[allStud$Category == '3.4 - 3.5' & allStud$'ECON 2010' == 'B-']),  
length(allStud$Category[allStud$Category == '3.5 - 3.6' & allStud$'ECON 2010' == 'B-']),  
length(allStud$Category[allStud$Category == '3.6 - 3.7' & allStud$'ECON 2010' == 'B-']),  
length(allStud$Category[allStud$Category == '3.7 - 3.8' & allStud$'ECON 2010' == 'B-']),  
length(allStud$Category[allStud$Category == '3.8 - 3.9' & allStud$'ECON 2010' == 'B-']),  
length(allStud$Category[allStud$Category == '3.9 - 4.0' & allStud$'ECON 2010' == 'B-']),  
  
length(allStud$Category[allStud$Category == '3.0 - 3.1' & allStud$'ECON 2010' == 'AP']),
```

```

length(allStud$Category[allStud$Category == '3.1 - 3.2' & allStud$'ECON 2010' == 'AP']),
length(allStud$Category[allStud$Category == '3.2 - 3.3' & allStud$'ECON 2010' == 'AP']),
length(allStud$Category[allStud$Category == '3.3 - 3.4' & allStud$'ECON 2010' == 'AP']),
length(allStud$Category[allStud$Category == '3.4 - 3.5' & allStud$'ECON 2010' == 'AP']),
length(allStud$Category[allStud$Category == '3.5 - 3.6' & allStud$'ECON 2010' == 'AP']),
length(allStud$Category[allStud$Category == '3.6 - 3.7' & allStud$'ECON 2010' == 'AP']),
length(allStud$Category[allStud$Category == '3.7 - 3.8' & allStud$'ECON 2010' == 'AP']),
length(allStud$Category[allStud$Category == '3.8 - 3.9' & allStud$'ECON 2010' == 'AP']),
length(allStud$Category[allStud$Category == '3.9 - 4.0' & allStud$'ECON 2010' == 'AP'])
)
)

ggplot(df, aes(x=Subgroup, y= Value, fill=Group)) +
  geom_bar(stat="identity", position="dodge") +
  scale_fill_manual(values=c("darkgreen", "red", "orange", 'purple', 'lightblue', 'violet', 'maroon'))
+
  labs(title="Subject/ CGPA Range/ Student Grades vs Count",
       x = "ECON 2010",
       y = "Count") +
  theme(legend.position="top")

## Student ECON 2020

df <- data.frame(
  Group = c('A+', 'A+', 'B+', 'B-', 'AP', 'AP')
)

```

```
Subgroup = c(unique(allStud$Category)[2],  
            unique(allStud$Category)[3],  
            unique(allStud$Category)[1],  
            unique(allStud$Category)[5],  
            unique(allStud$Category)[7],  
            unique(allStud$Category)[9],  
            unique(allStud$Category)[6],  
            unique(allStud$Category)[8],  
            unique(allStud$Category)[10],  
            unique(allStud$Category)[4]),  
  
Value = c(length(allStud$Category[allStud$Category == '3.0 - 3.1' & allStud$'ECON 2020' == 'A+']),  
         length(allStud$Category[allStud$Category == '3.1 - 3.2' & allStud$'ECON 2020' == 'A+']),  
         length(allStud$Category[allStud$Category == '3.2 - 3.3' & allStud$'ECON 2020' == 'A+']),  
         length(allStud$Category[allStud$Category == '3.3 - 3.4' & allStud$'ECON 2020' == 'A+']),  
         length(allStud$Category[allStud$Category == '3.4 - 3.5' & allStud$'ECON 2020' == 'A+']),  
         length(allStud$Category[allStud$Category == '3.5 - 3.6' & allStud$'ECON 2020' == 'A+']),  
         length(allStud$Category[allStud$Category == '3.6 - 3.7' & allStud$'ECON 2020' == 'A+']),  
         length(allStud$Category[allStud$Category == '3.7 - 3.8' & allStud$'ECON 2020' == 'A+']),  
         length(allStud$Category[allStud$Category == '3.8 - 3.9' & allStud$'ECON 2020' == 'A+']),  
         length(allStud$Category[allStud$Category == '3.9 - 4.0' & allStud$'ECON 2020' == 'A+']),  
  
         length(allStud$Category[allStud$Category == '3.0 - 3.1' & allStud$'ECON 2020' == 'A']),  
         length(allStud$Category[allStud$Category == '3.1 - 3.2' & allStud$'ECON 2020' == 'A']),  
         length(allStud$Category[allStud$Category == '3.2 - 3.3' & allStud$'ECON 2020' == 'A']),  
         length(allStud$Category[allStud$Category == '3.3 - 3.4' & allStud$'ECON 2020' == 'A']),  
         length(allStud$Category[allStud$Category == '3.4 - 3.5' & allStud$'ECON 2020' == 'A']),  
         length(allStud$Category[allStud$Category == '3.5 - 3.6' & allStud$'ECON 2020' == 'A']),  
         length(allStud$Category[allStud$Category == '3.6 - 3.7' & allStud$'ECON 2020' == 'A']),  
         length(allStud$Category[allStud$Category == '3.7 - 3.8' & allStud$'ECON 2020' == 'A']),  
         length(allStud$Category[allStud$Category == '3.8 - 3.9' & allStud$'ECON 2020' == 'A']),  
         length(allStud$Category[allStud$Category == '3.9 - 4.0' & allStud$'ECON 2020' == 'A']))
```

```
length(allStud$Category[allStud$Category == '3.0 - 3.1' & allStud$'ECON 2020' == 'A-' ]),  
length(allStud$Category[allStud$Category == '3.1 - 3.2' & allStud$'ECON 2020' == 'A-' ]),  
length(allStud$Category[allStud$Category == '3.2 - 3.3' & allStud$'ECON 2020' == 'A-' ]),  
length(allStud$Category[allStud$Category == '3.3 - 3.4' & allStud$'ECON 2020' == 'A-' ]),  
length(allStud$Category[allStud$Category == '3.4 - 3.5' & allStud$'ECON 2020' == 'A-' ]),  
length(allStud$Category[allStud$Category == '3.5 - 3.6' & allStud$'ECON 2020' == 'A-' ]),  
length(allStud$Category[allStud$Category == '3.6 - 3.7' & allStud$'ECON 2020' == 'A-' ]),  
length(allStud$Category[allStud$Category == '3.7 - 3.8' & allStud$'ECON 2020' == 'A-' ]),  
length(allStud$Category[allStud$Category == '3.8 - 3.9' & allStud$'ECON 2020' == 'A-' ]),  
length(allStud$Category[allStud$Category == '3.9 - 4.0' & allStud$'ECON 2020' == 'A-' ]),  
  
length(allStud$Category[allStud$Category == '3.0 - 3.1' & allStud$'ECON 2020' == 'B+' ]),  
length(allStud$Category[allStud$Category == '3.1 - 3.2' & allStud$'ECON 2020' == 'B+' ]),  
length(allStud$Category[allStud$Category == '3.2 - 3.3' & allStud$'ECON 2020' == 'B+' ]),  
length(allStud$Category[allStud$Category == '3.3 - 3.4' & allStud$'ECON 2020' == 'B+' ]),  
length(allStud$Category[allStud$Category == '3.4 - 3.5' & allStud$'ECON 2020' == 'B+' ]),  
length(allStud$Category[allStud$Category == '3.5 - 3.6' & allStud$'ECON 2020' == 'B+' ]),  
length(allStud$Category[allStud$Category == '3.6 - 3.7' & allStud$'ECON 2020' == 'B+' ]),  
length(allStud$Category[allStud$Category == '3.7 - 3.8' & allStud$'ECON 2020' == 'B+' ]),  
length(allStud$Category[allStud$Category == '3.8 - 3.9' & allStud$'ECON 2020' == 'B+' ]),  
length(allStud$Category[allStud$Category == '3.9 - 4.0' & allStud$'ECON 2020' == 'B+' ]),  
  
length(allStud$Category[allStud$Category == '3.0 - 3.1' & allStud$'ECON 2020' == 'B' ]),  
length(allStud$Category[allStud$Category == '3.1 - 3.2' & allStud$'ECON 2020' == 'B' ]),  
length(allStud$Category[allStud$Category == '3.2 - 3.3' & allStud$'ECON 2020' == 'B' ]),  
length(allStud$Category[allStud$Category == '3.3 - 3.4' & allStud$'ECON 2020' == 'B' ]),  
length(allStud$Category[allStud$Category == '3.4 - 3.5' & allStud$'ECON 2020' == 'B' ]),  
length(allStud$Category[allStud$Category == '3.5 - 3.6' & allStud$'ECON 2020' == 'B' ]),  
length(allStud$Category[allStud$Category == '3.6 - 3.7' & allStud$'ECON 2020' == 'B' ]),  
length(allStud$Category[allStud$Category == '3.7 - 3.8' & allStud$'ECON 2020' == 'B' ]),  
length(allStud$Category[allStud$Category == '3.8 - 3.9' & allStud$'ECON 2020' == 'B' ]),  
length(allStud$Category[allStud$Category == '3.9 - 4.0' & allStud$'ECON 2020' == 'B' ]),
```

```
length(allStud$Category[allStud$Category == '3.8 - 3.9' & allStud$'ECON 2020' == 'B']),  
length(allStud$Category[allStud$Category == '3.9 - 4.0' & allStud$'ECON 2020' == 'B']),  
  
length(allStud$Category[allStud$Category == '3.0 - 3.1' & allStud$'ECON 2020' == 'B-']),  
length(allStud$Category[allStud$Category == '3.1 - 3.2' & allStud$'ECON 2020' == 'B-']),  
length(allStud$Category[allStud$Category == '3.2 - 3.3' & allStud$'ECON 2020' == 'B-']),  
length(allStud$Category[allStud$Category == '3.3 - 3.4' & allStud$'ECON 2020' == 'B-']),  
length(allStud$Category[allStud$Category == '3.4 - 3.5' & allStud$'ECON 2020' == 'B-']),  
length(allStud$Category[allStud$Category == '3.5 - 3.6' & allStud$'ECON 2020' == 'B-']),  
length(allStud$Category[allStud$Category == '3.6 - 3.7' & allStud$'ECON 2020' == 'B-']),  
length(allStud$Category[allStud$Category == '3.7 - 3.8' & allStud$'ECON 2020' == 'B-']),  
length(allStud$Category[allStud$Category == '3.8 - 3.9' & allStud$'ECON 2020' == 'B-']),  
length(allStud$Category[allStud$Category == '3.9 - 4.0' & allStud$'ECON 2020' == 'B-']),  
  
length(allStud$Category[allStud$Category == '3.0 - 3.1' & allStud$'ECON 2020' == 'AP']),  
length(allStud$Category[allStud$Category == '3.1 - 3.2' & allStud$'ECON 2020' == 'AP']),  
length(allStud$Category[allStud$Category == '3.2 - 3.3' & allStud$'ECON 2020' == 'AP']),  
length(allStud$Category[allStud$Category == '3.3 - 3.4' & allStud$'ECON 2020' == 'AP']),  
length(allStud$Category[allStud$Category == '3.4 - 3.5' & allStud$'ECON 2020' == 'AP']),  
length(allStud$Category[allStud$Category == '3.5 - 3.6' & allStud$'ECON 2020' == 'AP']),  
length(allStud$Category[allStud$Category == '3.6 - 3.7' & allStud$'ECON 2020' == 'AP']),  
length(allStud$Category[allStud$Category == '3.7 - 3.8' & allStud$'ECON 2020' == 'AP']),  
length(allStud$Category[allStud$Category == '3.8 - 3.9' & allStud$'ECON 2020' == 'AP']),  
length(allStud$Category[allStud$Category == '3.9 - 4.0' & allStud$'ECON 2020' == 'AP'])  
)  
)  
  
ggplot(df, aes(x=Subgroup, y= Value, fill=Group)) +  
  geom_bar(stat="identity", position="dodge") +  
  scale_fill_manual(values=c("darkgreen", "red", "orange", 'purple', 'lightblue', 'violet', 'maroon'))  
+
```

```

labs(title="Subject/ CGPA Range/ Student Grades vs Count",
     x = "ECON 2010",
     y = "Count") +
theme(legend.position="top")

## Student MATH 1112

df <- data.frame(
  Group = c('A+', 'A+', 'A-', 'B+', 'B-', 'AP', 'AP'),
  Subgroup = c(unique(allStud$Category)[2],
               unique(allStud$Category)[3],
               unique(allStud$Category)[1],
               unique(allStud$Category)[5],
               unique(allStud$Category)[7],
               unique(allStud$Category)[9],
               unique(allStud$Category)[6],
               unique(allStud$Category)[8],
               unique(allStud$Category)[10],
               unique(allStud$Category)[4]),
  Value = c(length(allStud$Category[allStud$Category == '3.0 - 3.1' & allStud$'MATH 1112' == 'A+']),
            length(allStud$Category[allStud$Category == '3.1 - 3.2' & allStud$'MATH 1112' == 'A+']),
            length(allStud$Category[allStud$Category == '3.2 - 3.3' & allStud$'MATH 1112' == 'A+']),
            length(allStud$Category[allStud$Category == '3.3 - 3.4' & allStud$'MATH 1112' == 'A+']),
            length(allStud$Category[allStud$Category == '3.4 - 3.5' & allStud$'MATH 1112' == 'A+']),
            length(allStud$Category[allStud$Category == '3.5 - 3.6' & allStud$'MATH 1112' == 'A+']))
)

```

```
length(allStud$Category[allStud$Category == '3.6 - 3.7' & allStud$"MATH 1112" == 'A+']),  
length(allStud$Category[allStud$Category == '3.7 - 3.8' & allStud$"MATH 1112" == 'A+']),  
length(allStud$Category[allStud$Category == '3.8 - 3.9' & allStud$"MATH 1112" == 'A+']),  
length(allStud$Category[allStud$Category == '3.9 - 4.0' & allStud$"MATH 1112" == 'A+']),  
  
length(allStud$Category[allStud$Category == '3.0 - 3.1' & allStud$"MATH 1112" == 'A']),  
length(allStud$Category[allStud$Category == '3.1 - 3.2' & allStud$"MATH 1112" == 'A']),  
length(allStud$Category[allStud$Category == '3.2 - 3.3' & allStud$"MATH 1112" == 'A']),  
length(allStud$Category[allStud$Category == '3.3 - 3.4' & allStud$"MATH 1112" == 'A']),  
length(allStud$Category[allStud$Category == '3.4 - 3.5' & allStud$"MATH 1112" == 'A']),  
length(allStud$Category[allStud$Category == '3.5 - 3.6' & allStud$"MATH 1112" == 'A']),  
length(allStud$Category[allStud$Category == '3.6 - 3.7' & allStud$"MATH 1112" == 'A']),  
length(allStud$Category[allStud$Category == '3.7 - 3.8' & allStud$"MATH 1112" == 'A']),  
length(allStud$Category[allStud$Category == '3.8 - 3.9' & allStud$"MATH 1112" == 'A']),  
length(allStud$Category[allStud$Category == '3.9 - 4.0' & allStud$"MATH 1112" == 'A']),  
  
length(allStud$Category[allStud$Category == '3.0 - 3.1' & allStud$"MATH 1112" == 'A-']),  
length(allStud$Category[allStud$Category == '3.1 - 3.2' & allStud$"MATH 1112" == 'A-']),  
length(allStud$Category[allStud$Category == '3.2 - 3.3' & allStud$"MATH 1112" == 'A-']),  
length(allStud$Category[allStud$Category == '3.3 - 3.4' & allStud$"MATH 1112" == 'A-']),  
length(allStud$Category[allStud$Category == '3.4 - 3.5' & allStud$"MATH 1112" == 'A-']),  
length(allStud$Category[allStud$Category == '3.5 - 3.6' & allStud$"MATH 1112" == 'A-']),  
length(allStud$Category[allStud$Category == '3.6 - 3.7' & allStud$"MATH 1112" == 'A-']),  
length(allStud$Category[allStud$Category == '3.7 - 3.8' & allStud$"MATH 1112" == 'A-']),  
length(allStud$Category[allStud$Category == '3.8 - 3.9' & allStud$"MATH 1112" == 'A-']),  
length(allStud$Category[allStud$Category == '3.9 - 4.0' & allStud$"MATH 1112" == 'A-']),  
  
length(allStud$Category[allStud$Category == '3.0 - 3.1' & allStud$"MATH 1112" == 'B+']),  
length(allStud$Category[allStud$Category == '3.1 - 3.2' & allStud$"MATH 1112" == 'B+']),  
length(allStud$Category[allStud$Category == '3.2 - 3.3' & allStud$"MATH 1112" == 'B+']),  
length(allStud$Category[allStud$Category == '3.3 - 3.4' & allStud$"MATH 1112" == 'B+'])
```

```
length(allStud$Category[allStud$Category == '3.4 - 3.5' & allStud$"MATH 1112" == 'B+']),  
length(allStud$Category[allStud$Category == '3.5 - 3.6' & allStud$"MATH 1112" == 'B+']),  
length(allStud$Category[allStud$Category == '3.6 - 3.7' & allStud$"MATH 1112" == 'B+']),  
length(allStud$Category[allStud$Category == '3.7 - 3.8' & allStud$"MATH 1112" == 'B+']),  
length(allStud$Category[allStud$Category == '3.8 - 3.9' & allStud$"MATH 1112" == 'B+']),  
length(allStud$Category[allStud$Category == '3.9 - 4.0' & allStud$"MATH 1112" == 'B+']),  
  
length(allStud$Category[allStud$Category == '3.0 - 3.1' & allStud$"MATH 1112" == 'B']),  
length(allStud$Category[allStud$Category == '3.1 - 3.2' & allStud$"MATH 1112" == 'B']),  
length(allStud$Category[allStud$Category == '3.2 - 3.3' & allStud$"MATH 1112" == 'B']),  
length(allStud$Category[allStud$Category == '3.3 - 3.4' & allStud$"MATH 1112" == 'B']),  
length(allStud$Category[allStud$Category == '3.4 - 3.5' & allStud$"MATH 1112" == 'B']),  
length(allStud$Category[allStud$Category == '3.5 - 3.6' & allStud$"MATH 1112" == 'B']),  
length(allStud$Category[allStud$Category == '3.6 - 3.7' & allStud$"MATH 1112" == 'B']),  
length(allStud$Category[allStud$Category == '3.7 - 3.8' & allStud$"MATH 1112" == 'B']),  
length(allStud$Category[allStud$Category == '3.8 - 3.9' & allStud$"MATH 1112" == 'B']),  
length(allStud$Category[allStud$Category == '3.9 - 4.0' & allStud$"MATH 1112" == 'B']),  
  
length(allStud$Category[allStud$Category == '3.0 - 3.1' & allStud$"MATH 1112" == 'B-']),  
length(allStud$Category[allStud$Category == '3.1 - 3.2' & allStud$"MATH 1112" == 'B-']),  
length(allStud$Category[allStud$Category == '3.2 - 3.3' & allStud$"MATH 1112" == 'B-']),  
length(allStud$Category[allStud$Category == '3.3 - 3.4' & allStud$"MATH 1112" == 'B-']),  
length(allStud$Category[allStud$Category == '3.4 - 3.5' & allStud$"MATH 1112" == 'B-']),  
length(allStud$Category[allStud$Category == '3.5 - 3.6' & allStud$"MATH 1112" == 'B-']),  
length(allStud$Category[allStud$Category == '3.6 - 3.7' & allStud$"MATH 1112" == 'B-']),  
length(allStud$Category[allStud$Category == '3.7 - 3.8' & allStud$"MATH 1112" == 'B-']),  
length(allStud$Category[allStud$Category == '3.8 - 3.9' & allStud$"MATH 1112" == 'B-']),  
length(allStud$Category[allStud$Category == '3.9 - 4.0' & allStud$"MATH 1112" == 'B-']),  
  
length(allStud$Category[allStud$Category == '3.0 - 3.1' & allStud$"MATH 1112" == 'AP']),  
length(allStud$Category[allStud$Category == '3.1 - 3.2' & allStud$"MATH 1112" == 'AP'])
```

```

length(allStud$Category[allStud$Category == '3.2 - 3.3' & allStud$"MATH 1112" == 'AP']),
length(allStud$Category[allStud$Category == '3.3 - 3.4' & allStud$"MATH 1112" == 'AP']),
length(allStud$Category[allStud$Category == '3.4 - 3.5' & allStud$"MATH 1112" == 'AP']),
length(allStud$Category[allStud$Category == '3.5 - 3.6' & allStud$"MATH 1112" == 'AP']),
length(allStud$Category[allStud$Category == '3.6 - 3.7' & allStud$"MATH 1112" == 'AP']),
length(allStud$Category[allStud$Category == '3.7 - 3.8' & allStud$"MATH 1112" == 'AP']),
length(allStud$Category[allStud$Category == '3.8 - 3.9' & allStud$"MATH 1112" == 'AP']),
length(allStud$Category[allStud$Category == '3.9 - 4.0' & allStud$"MATH 1112" == 'AP'])
)
)
)

ggplot(df, aes(x=Subgroup, y= Value, fill=Group)) +
  geom_bar(stat="identity", position="dodge") +
  scale_fill_manual(values=c("darkgreen", "red", "orange", 'purple', 'lightblue', 'violet', 'maroon'))
+
  labs(title="Subject/ CGPA Range/ Student Grades vs Count",
       x = "MATH 1112",
       y = "Count") +
  theme(legend.position="top")

## Student MATH 2510/ STATS

df <- data.frame(
  Group = c('A+', 'A+', 'B+', 'B-', 'AP', 'AP'),
  Subgroup = c(unique(allStud$Category)[2],

```

```
unique(allStud$Category)[3],  
unique(allStud$Category)[1],  
unique(allStud$Category)[5],  
unique(allStud$Category)[7],  
unique(allStud$Category)[9],  
unique(allStud$Category)[6],  
unique(allStud$Category)[8],  
unique(allStud$Category)[10],  
unique(allStud$Category)[4]),  
  
Value = c(length(allStud$Category[allStud$Category == '3.0 - 3.1' & allStud$'MATH 2510' == 'A+']),  
length(allStud$Category[allStud$Category == '3.1 - 3.2' & allStud$'MATH 2510' == 'A+']),  
length(allStud$Category[allStud$Category == '3.2 - 3.3' & allStud$'MATH 2510' == 'A+']),  
length(allStud$Category[allStud$Category == '3.3 - 3.4' & allStud$'MATH 2510' == 'A+']),  
length(allStud$Category[allStud$Category == '3.4 - 3.5' & allStud$'MATH 2510' == 'A+']),  
length(allStud$Category[allStud$Category == '3.5 - 3.6' & allStud$'MATH 2510' == 'A+']),  
length(allStud$Category[allStud$Category == '3.6 - 3.7' & allStud$'MATH 2510' == 'A+']),  
length(allStud$Category[allStud$Category == '3.7 - 3.8' & allStud$'MATH 2510' == 'A+']),  
length(allStud$Category[allStud$Category == '3.8 - 3.9' & allStud$'MATH 2510' == 'A+']),  
length(allStud$Category[allStud$Category == '3.9 - 4.0' & allStud$'MATH 2510' == 'A+']),  
  
length(allStud$Category[allStud$Category == '3.0 - 3.1' & allStud$'MATH 2510' == 'A']),  
length(allStud$Category[allStud$Category == '3.1 - 3.2' & allStud$'MATH 2510' == 'A']),  
length(allStud$Category[allStud$Category == '3.2 - 3.3' & allStud$'MATH 2510' == 'A']),  
length(allStud$Category[allStud$Category == '3.3 - 3.4' & allStud$'MATH 2510' == 'A']),  
length(allStud$Category[allStud$Category == '3.4 - 3.5' & allStud$'MATH 2510' == 'A']),  
length(allStud$Category[allStud$Category == '3.5 - 3.6' & allStud$'MATH 2510' == 'A']),  
length(allStud$Category[allStud$Category == '3.6 - 3.7' & allStud$'MATH 2510' == 'A']),  
length(allStud$Category[allStud$Category == '3.7 - 3.8' & allStud$'MATH 2510' == 'A']),  
length(allStud$Category[allStud$Category == '3.8 - 3.9' & allStud$'MATH 2510' == 'A']),  
length(allStud$Category[allStud$Category == '3.9 - 4.0' & allStud$'MATH 2510' == 'A']),
```

```
length(allStud$Category[allStud$Category == '3.0 - 3.1' & allStud$"MATH 2510" == 'A-' ]),  
length(allStud$Category[allStud$Category == '3.1 - 3.2' & allStud$"MATH 2510" == 'A-' ]),  
length(allStud$Category[allStud$Category == '3.2 - 3.3' & allStud$"MATH 2510" == 'A-' ]),  
length(allStud$Category[allStud$Category == '3.3 - 3.4' & allStud$"MATH 2510" == 'A-' ]),  
length(allStud$Category[allStud$Category == '3.4 - 3.5' & allStud$"MATH 2510" == 'A-' ]),  
length(allStud$Category[allStud$Category == '3.5 - 3.6' & allStud$"MATH 2510" == 'A-' ]),  
length(allStud$Category[allStud$Category == '3.6 - 3.7' & allStud$"MATH 2510" == 'A-' ]),  
length(allStud$Category[allStud$Category == '3.7 - 3.8' & allStud$"MATH 2510" == 'A-' ]),  
length(allStud$Category[allStud$Category == '3.8 - 3.9' & allStud$"MATH 2510" == 'A-' ]),  
length(allStud$Category[allStud$Category == '3.9 - 4.0' & allStud$"MATH 2510" == 'A-' ]),  
  
length(allStud$Category[allStud$Category == '3.0 - 3.1' & allStud$"MATH 2510" == 'B+' ]),  
length(allStud$Category[allStud$Category == '3.1 - 3.2' & allStud$"MATH 2510" == 'B+' ]),  
length(allStud$Category[allStud$Category == '3.2 - 3.3' & allStud$"MATH 2510" == 'B+' ]),  
length(allStud$Category[allStud$Category == '3.3 - 3.4' & allStud$"MATH 2510" == 'B+' ]),  
length(allStud$Category[allStud$Category == '3.4 - 3.5' & allStud$"MATH 2510" == 'B+' ]),  
length(allStud$Category[allStud$Category == '3.5 - 3.6' & allStud$"MATH 2510" == 'B+' ]),  
length(allStud$Category[allStud$Category == '3.6 - 3.7' & allStud$"MATH 2510" == 'B+' ]),  
length(allStud$Category[allStud$Category == '3.7 - 3.8' & allStud$"MATH 2510" == 'B+' ]),  
length(allStud$Category[allStud$Category == '3.8 - 3.9' & allStud$"MATH 2510" == 'B+' ]),  
length(allStud$Category[allStud$Category == '3.9 - 4.0' & allStud$"MATH 2510" == 'B+' ]),  
  
length(allStud$Category[allStud$Category == '3.0 - 3.1' & allStud$"MATH 2510" == 'B' ]),  
length(allStud$Category[allStud$Category == '3.1 - 3.2' & allStud$"MATH 2510" == 'B' ]),  
length(allStud$Category[allStud$Category == '3.2 - 3.3' & allStud$"MATH 2510" == 'B' ]),  
length(allStud$Category[allStud$Category == '3.3 - 3.4' & allStud$"MATH 2510" == 'B' ]),  
length(allStud$Category[allStud$Category == '3.4 - 3.5' & allStud$"MATH 2510" == 'B' ]),  
length(allStud$Category[allStud$Category == '3.5 - 3.6' & allStud$"MATH 2510" == 'B' ]),  
length(allStud$Category[allStud$Category == '3.6 - 3.7' & allStud$"MATH 2510" == 'B' ]),  
length(allStud$Category[allStud$Category == '3.7 - 3.8' & allStud$"MATH 2510" == 'B' ]),  
length(allStud$Category[allStud$Category == '3.8 - 3.9' & allStud$"MATH 2510" == 'B' ]),  
length(allStud$Category[allStud$Category == '3.9 - 4.0' & allStud$"MATH 2510" == 'B' ]),
```

```

length(allStud$Category[allStud$Category == '3.9 - 4.0' & allStud$"MATH 2510" == 'B']),  

length(allStud$Category[allStud$Category == '3.0 - 3.1' & allStud$"MATH 2510" == 'B-']),  

length(allStud$Category[allStud$Category == '3.1 - 3.2' & allStud$"MATH 2510" == 'B-']),  

length(allStud$Category[allStud$Category == '3.2 - 3.3' & allStud$"MATH 2510" == 'B-']),  

length(allStud$Category[allStud$Category == '3.3 - 3.4' & allStud$"MATH 2510" == 'B-']),  

length(allStud$Category[allStud$Category == '3.4 - 3.5' & allStud$"MATH 2510" == 'B-']),  

length(allStud$Category[allStud$Category == '3.5 - 3.6' & allStud$"MATH 2510" == 'B-']),  

length(allStud$Category[allStud$Category == '3.6 - 3.7' & allStud$"MATH 2510" == 'B-']),  

length(allStud$Category[allStud$Category == '3.7 - 3.8' & allStud$"MATH 2510" == 'B-']),  

length(allStud$Category[allStud$Category == '3.8 - 3.9' & allStud$"MATH 2510" == 'B-']),  

length(allStud$Category[allStud$Category == '3.9 - 4.0' & allStud$"MATH 2510" == 'B-']),  

length(allStud$Category[allStud$Category == '3.0 - 3.1' & allStud$"MATH 2510" == 'AP']),  

length(allStud$Category[allStud$Category == '3.1 - 3.2' & allStud$"MATH 2510" == 'AP']),  

length(allStud$Category[allStud$Category == '3.2 - 3.3' & allStud$"MATH 2510" == 'AP']),  

length(allStud$Category[allStud$Category == '3.3 - 3.4' & allStud$"MATH 2510" == 'AP']),  

length(allStud$Category[allStud$Category == '3.4 - 3.5' & allStud$"MATH 2510" == 'AP']),  

length(allStud$Category[allStud$Category == '3.5 - 3.6' & allStud$"MATH 2510" == 'AP']),  

length(allStud$Category[allStud$Category == '3.6 - 3.7' & allStud$"MATH 2510" == 'AP']),  

length(allStud$Category[allStud$Category == '3.7 - 3.8' & allStud$"MATH 2510" == 'AP']),  

length(allStud$Category[allStud$Category == '3.8 - 3.9' & allStud$"MATH 2510" == 'AP']),  

length(allStud$Category[allStud$Category == '3.9 - 4.0' & allStud$"MATH 2510" == 'AP'])  

)  

)  

ggplot(df, aes(x=Subgroup, y= Value, fill=Group)) +  

  geom_bar(stat="identity", position="dodge") +  

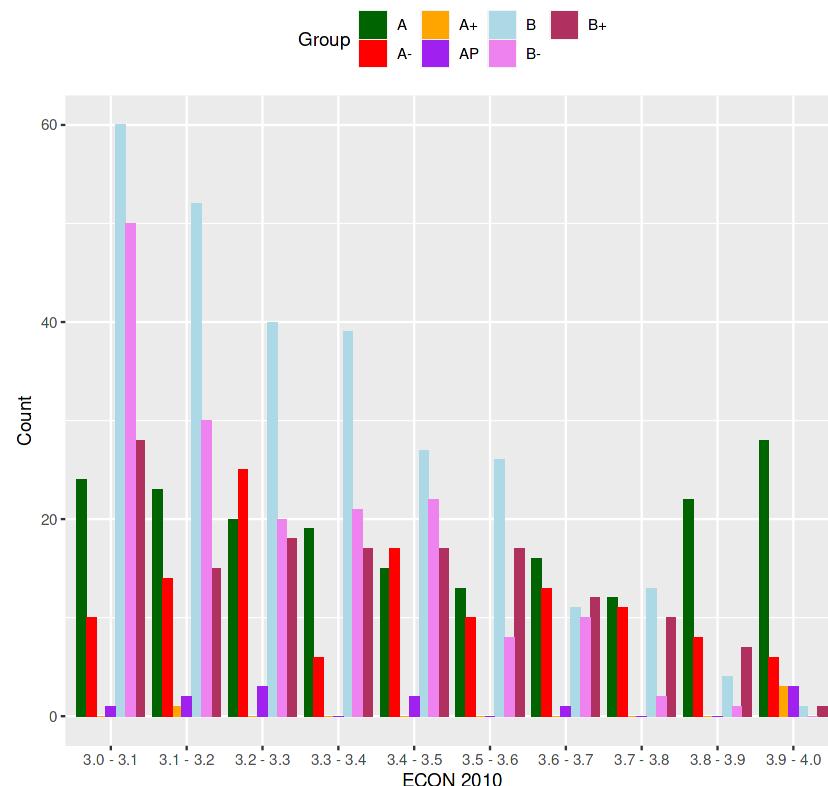
  scale_fill_manual(values=c("darkgreen", "red", "orange", 'purple', 'lightblue', 'violet', 'maroon'))  

+
  labs(title="Subject/ CGPA Range/ Student Grades vs Count",

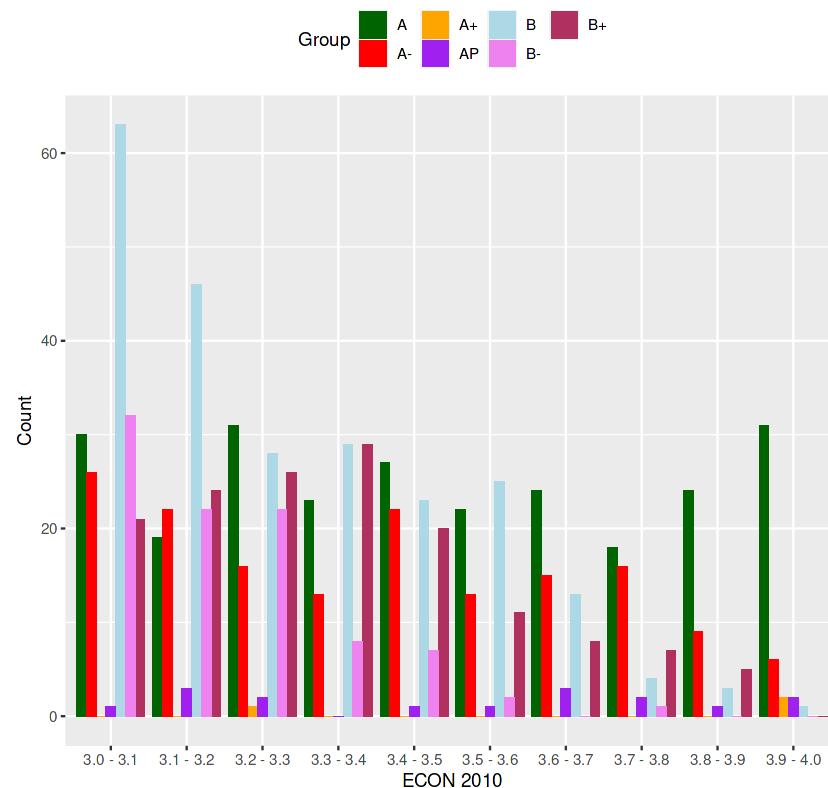
```

```
x = "STATS",  
y = "Count") +  
theme(legend.position="top")
```

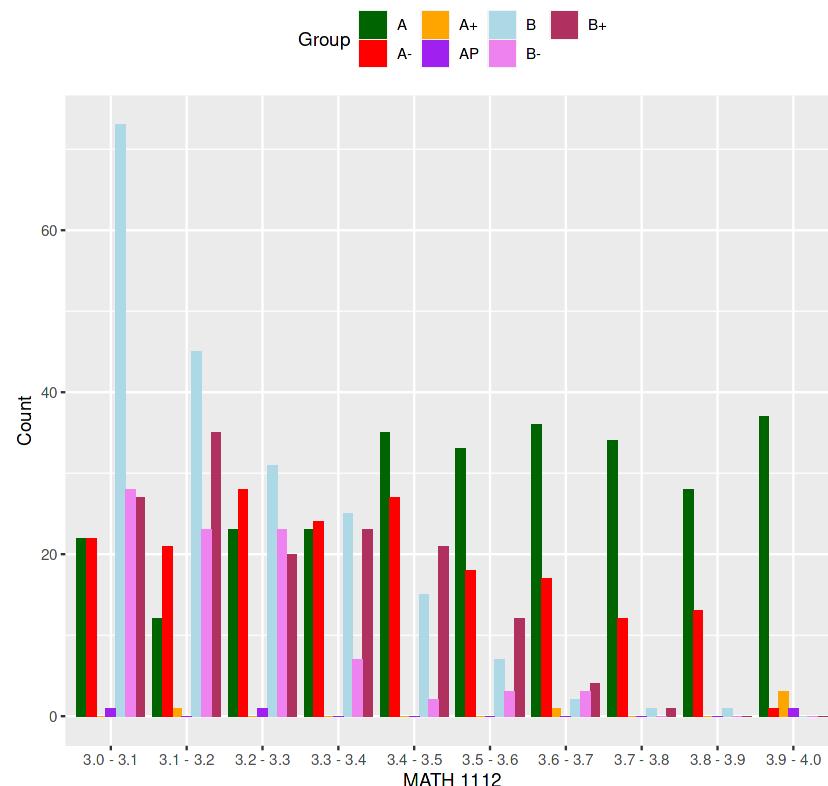
Subject/ CGPA Range/ Student Grades vs Count



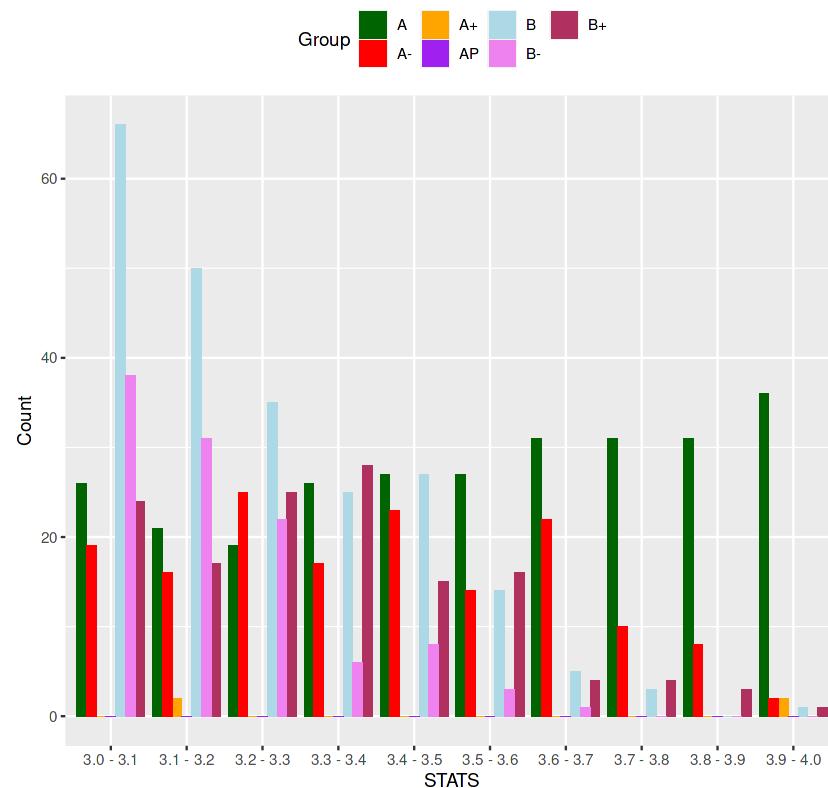
Subject/ CGPA Range/ Student Grades vs Count



Subject/ CGPA Range/ Student Grades vs Count



Subject/ CGPA Range/ Student Grades vs Count



In [12]:

```
#####
# Method 3 Analysis ##
#####

# Adjusting GPA and Grades together

# Original Condition: Each Course >= B- , and Cumulative GPA >= 3.0

allStud$row_count <- 1
aggregated_data <- aggregate(row_count ~`Cumulative GPA` + `ECON 2010` + `ECON 2020` + `MATH 1112` + `MATH 2510`, FUN = length, data = allStud)

sum(aggregated_data$row_count)

# Goal 25%: 681

# Condition: ECON 2010 >= B , and Cumulative GPA > 3.05

filtered_df <- aggregated_data %>%
  filter(`ECON 2010` %in% c("B", "B+", "A-", "A", "A+", "AP") & # `ECON 2010` >B-
    `ECON 2020` %in% c("B-", "B", "B+", "A-", "A", "A+", "AP") &
    `MATH 1112` %in% c("B-", "B", "B+", "A-", "A", "A+", "AP") &
    `MATH 2510` %in% c("B-", "B", "B+", "A-", "A", "A+", "AP") &
    `Cumulative GPA` >3.05)    #`Cumulative GPA` >3.05

sum(filtered_df$row_count) # Result: 678

# Goal 50%: 454

# Condition: Each Course >= B , and Cumulative GPA > 3.15
```

```
filtered_df <- aggregated_data %>%  
  filter(`ECON 2010` %in% c("B", "B+", "A-", "A", "A+", "AP") &  
        `ECON 2020` %in% c("B", "B+", "A-", "A", "A+", "AP") &  
        `MATH 1112` %in% c("B", "B+", "A-", "A", "A+", "AP") &  
        `MATH 2510` %in% c("B", "B+", "A-", "A", "A+", "AP") &  
        `Cumulative GPA` > 3.15)  
  
sum(filtered_df$row_count) # Result: 451
```

907

678

451