eda la2

shruthi s rao 1nt20is158

2023-05-22

```
library(readxl)
telecom <- read_excel("C:/Users/user/Downloads/telecom.xlsx")
View(telecom)
summary(telecom)
```

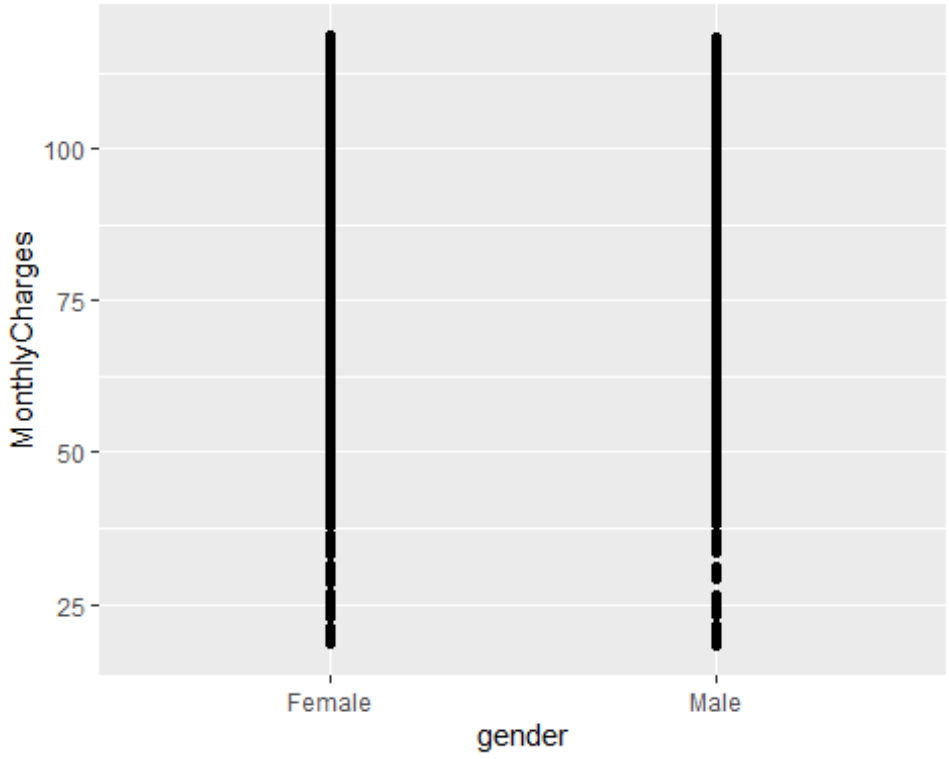
```
##   customerID          gender          SeniorCitizen      Partner
##  Length:7043        Length:7043        Min.   :0.0000   Length:7043
##  Class :character   Class :character   1st Qu.:0.0000   Class :character
##  Mode  :character   Mode  :character   Median :0.0000   Mode  :character
##                                        Mean   :0.1621
##                                        3rd Qu.:0.0000
##                                        Max.   :1.0000
##
##   Dependents            tenure      PhoneService       MultipleLines
##  Length:7043        Min.   : 0.00   Length:7043        Length:7043
##  Class :character   1st Qu.: 9.00   Class :character   Class :character
##  Mode  :character   Median :29.00   Mode  :character   Mode  :character
##                     Mean   :32.37
##                     3rd Qu.:55.00
##                     Max.   :72.00
##
##  InternetService    OnlineSecurity     OnlineBackup       DeviceProtection
##  Length:7043        Length:7043        Length:7043        Length:7043
##  Class :character   Class :character   Class :character   Class :character
##  Mode  :character   Mode  :character   Mode  :character   Mode  :character
##
##
##
##
##  TechSupport        StreamingTV        StreamingMovies      Contract
##  Length:7043        Length:7043        Length:7043        Length:7043
##  Class :character   Class :character   Class :character   Class :character
##  Mode  :character   Mode  :character   Mode  :character   Mode  :character
##
##
##
##
##  PaperlessBilling   PaymentMethod      MonthlyCharges    TotalCharges
##  Length:7043        Length:7043        Min.   : 18.25   Min.   :  18.8
##  Class :character   Class :character   1st Qu.: 35.50   1st Qu.: 401.4
##  Mode  :character   Mode  :character   Median : 70.35   Median :1397.5
##                                        Mean   : 64.76   Mean   :2283.3
```

```
##                                          3rd Qu.: 89.85   3rd Qu.:3794.7
##                                          Max.   :118.75   Max.   :8684.8
##                                                           NA's   :11
##     Churn
##  Length:7043
##  Class :character
##  Mode  :character
##
##
##
##
```

```
str(telecom)
```

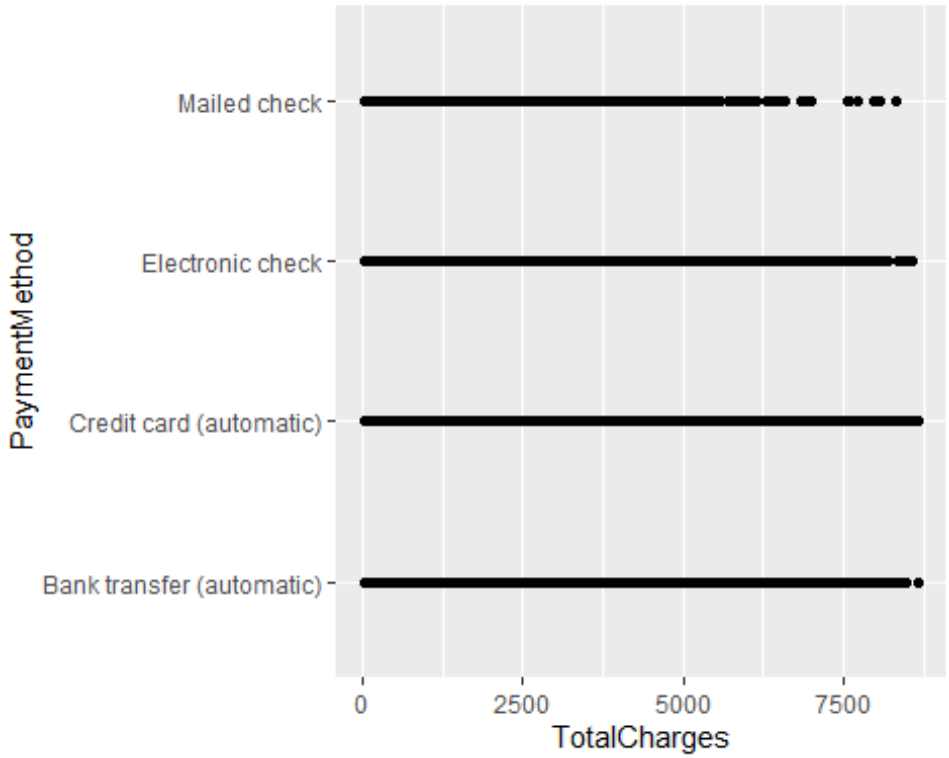
```
## tibble [7,043 × 21] (S3: tbl_df/tbl/data.frame)
##  $ customerID      : chr [1:7043] "7590-VHVEG" "5575-GNVDE" "3668-QPYBK" "
7795-CFOCW" ...
##  $ gender          : chr [1:7043] "Female" "Male" "Male" "Male" ...
##  $ SeniorCitizen   : num [1:7043] 0 0 0 0 0 0 0 0 0 0 ...
##  $ Partner         : chr [1:7043] "Yes" "No" "No" "No" ...
##  $ Dependents      : chr [1:7043] "No" "No" "No" "No" ...
##  $ tenure          : num [1:7043] 1 34 2 45 2 8 22 10 28 62 ...
##  $ PhoneService    : chr [1:7043] "No" "Yes" "Yes" "No" ...
##  $ MultipleLines   : chr [1:7043] "No phone service" "No" "No" "No phone s
ervice" ...
##  $ InternetService : chr [1:7043] "DSL" "DSL" "DSL" "DSL" ...
##  $ OnlineSecurity  : chr [1:7043] "No" "Yes" "Yes" "Yes" ...
##  $ OnlineBackup    : chr [1:7043] "Yes" "No" "Yes" "No" ...
##  $ DeviceProtection: chr [1:7043] "No" "Yes" "No" "Yes" ...
##  $ TechSupport     : chr [1:7043] "No" "No" "No" "Yes" ...
##  $ StreamingTV     : chr [1:7043] "No" "No" "No" "No" ...
##  $ StreamingMovies : chr [1:7043] "No" "No" "No" "No" ...
##  $ Contract        : chr [1:7043] "Month-to-month" "One year" "Month-to-mo
nth" "One year" ...
##  $ PaperlessBilling: chr [1:7043] "Yes" "No" "Yes" "No" ...
##  $ PaymentMethod   : chr [1:7043] "Electronic check" "Mailed check" "Maile
d check" "Bank transfer (automatic)" ...
##  $ MonthlyCharges  : num [1:7043] 29.9 57 53.9 42.3 70.7 ...
##  $ TotalCharges    : num [1:7043] 29.9 1889.5 108.2 1840.8 151.7 ...
##  $ Churn           : chr [1:7043] "No" "No" "Yes" "No" ...
```

```
library(ggplot2)
ggplot(telecom,aes(x=gender,y=MonthlyCharges))+geom_point()
```



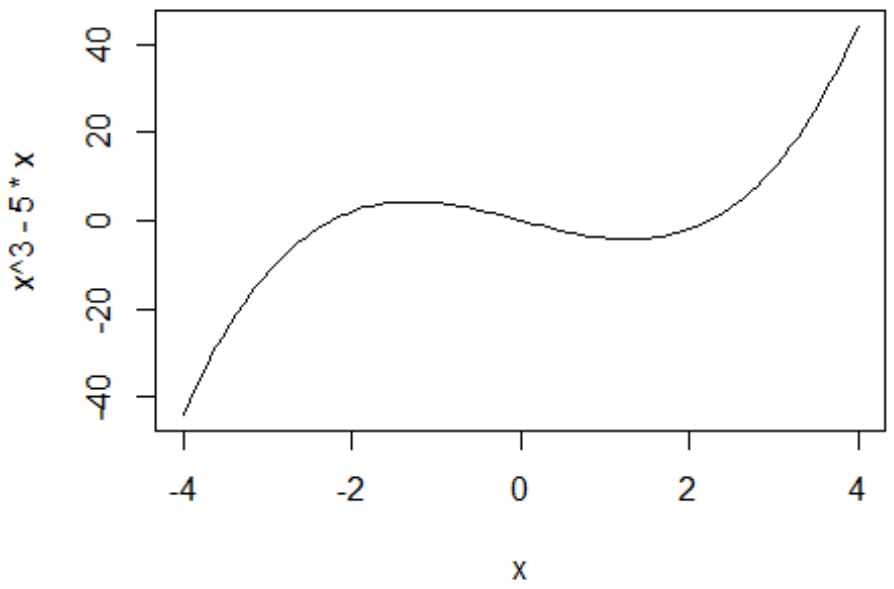

```
ggplot(telecom,aes(x=TotalCharges,y=PaymentMethod))+geom_point()
```

```
## Warning: Removed 11 rows containing missing values (`geom_point()`).
```

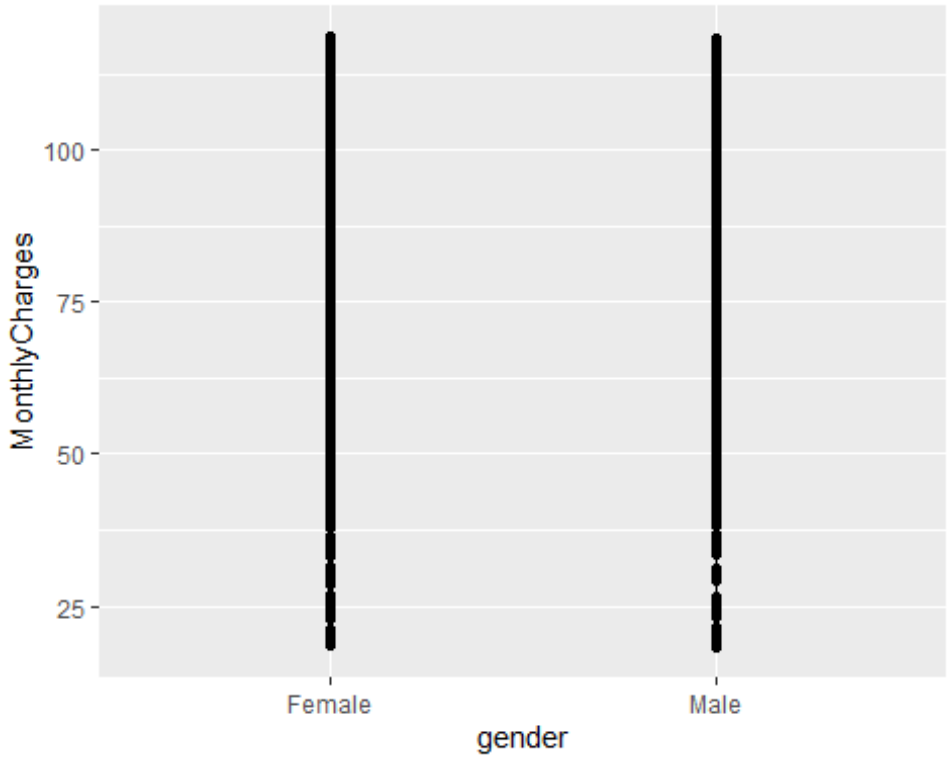


```
library(ggplot2)
ggplot(telecom,aes(x=gender,y=Partner))+geom_line()
```

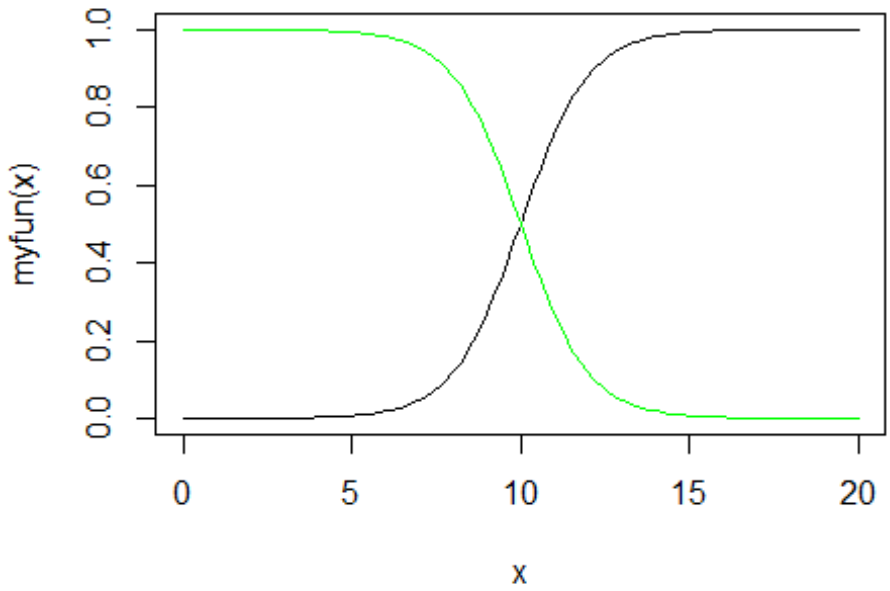

```
curve(x^3-5*x,from=-4,to=4)
```



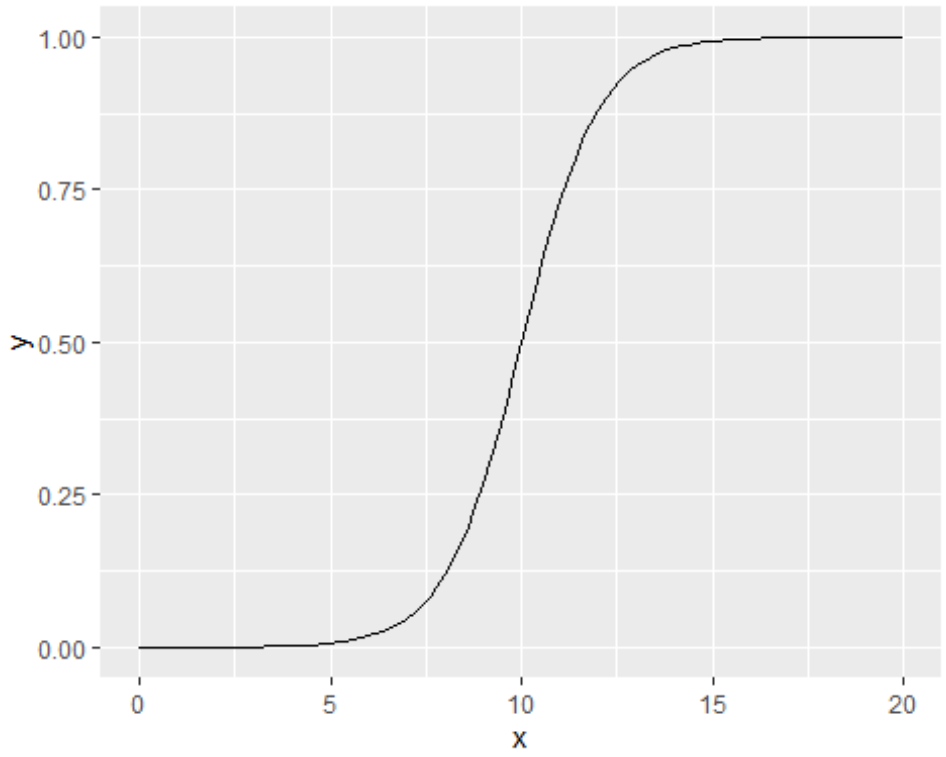

```
ggplot(telecom,aes(x=gender,y=MonthlyCharges))+geom_line()+geom_point()
```



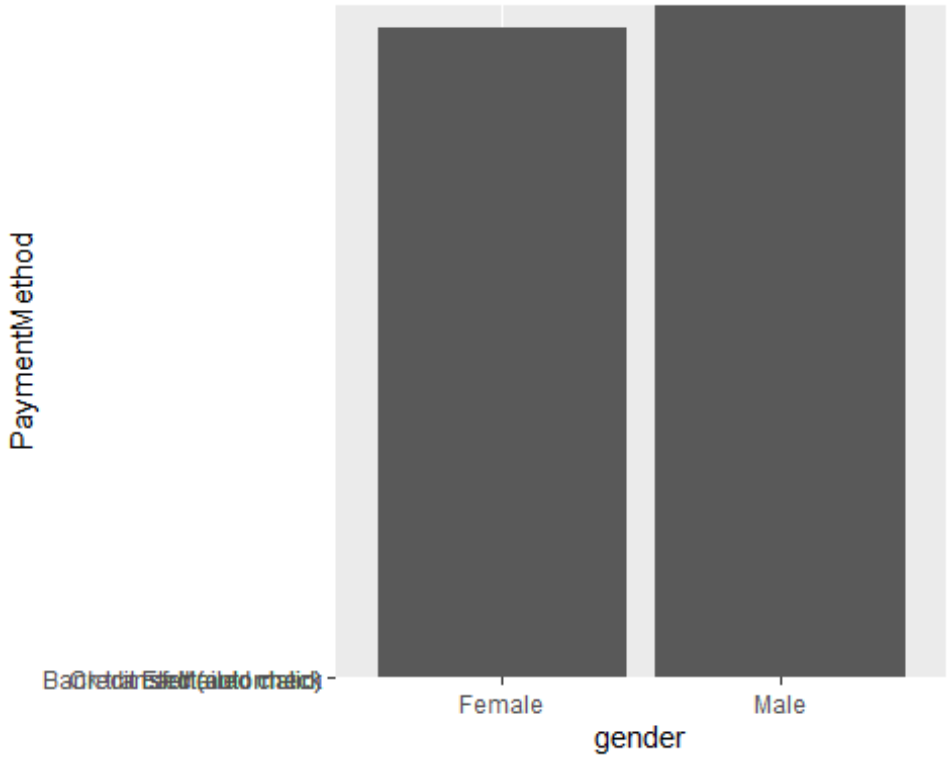
```r
##plot a user defined function
myfun<-function(xvar){
  1/( 1+exp(-xvar+10))
}
curve(myfun(x),from=0,to=20)
##add a line
curve(1 - myfun(x),add=TRUE,col="green")
```



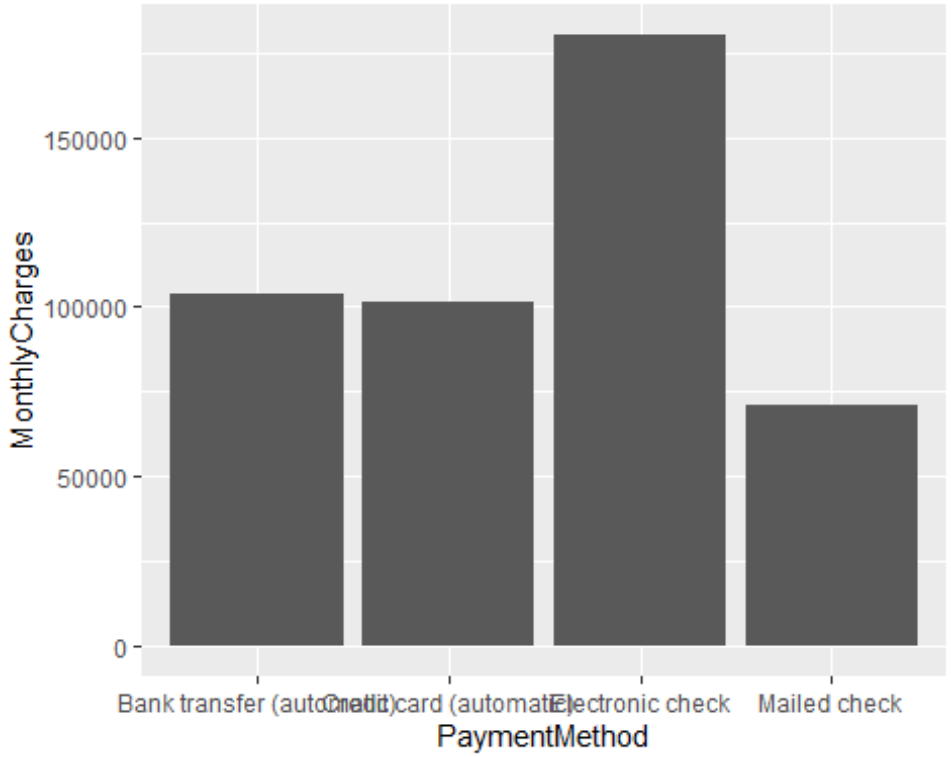

```r
library(ggplot2)
ggplot(data.frame(x=c(0,20)),aes(x=x))+stat_function(fun=myfun,geom="line")
```




```
library(gcookbook)
ggplot(telecom,aes(x=gender,y=PaymentMethod))+geom_col()
```

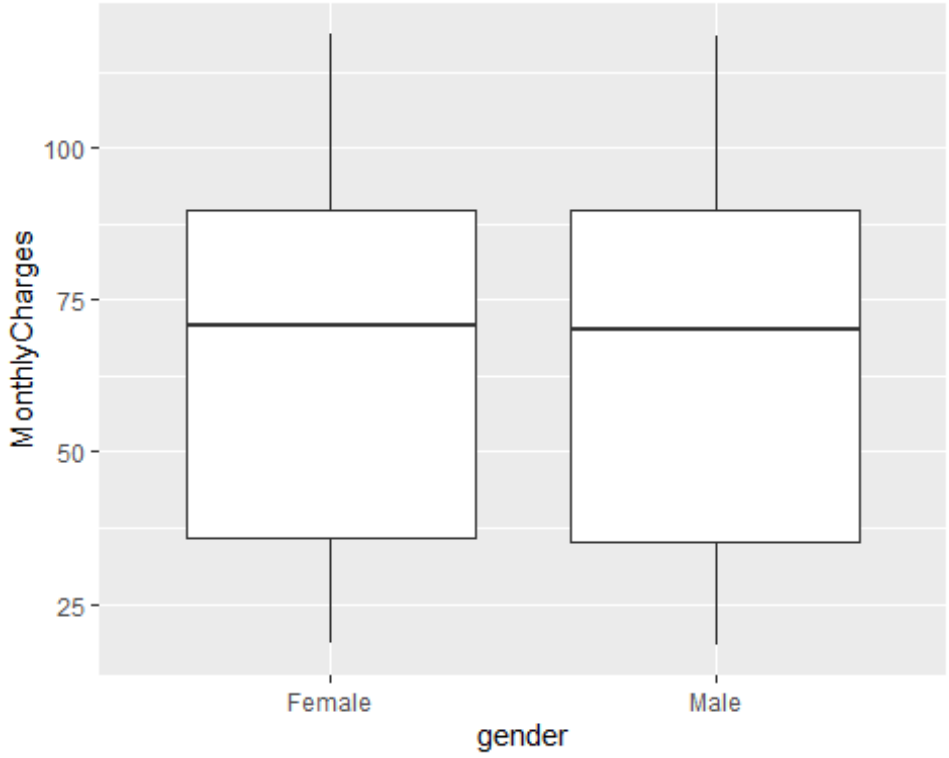


```
library(gcookbook)
ggplot(telecom,aes(x=PaymentMethod,y=MonthlyCharges))+geom_col()
```

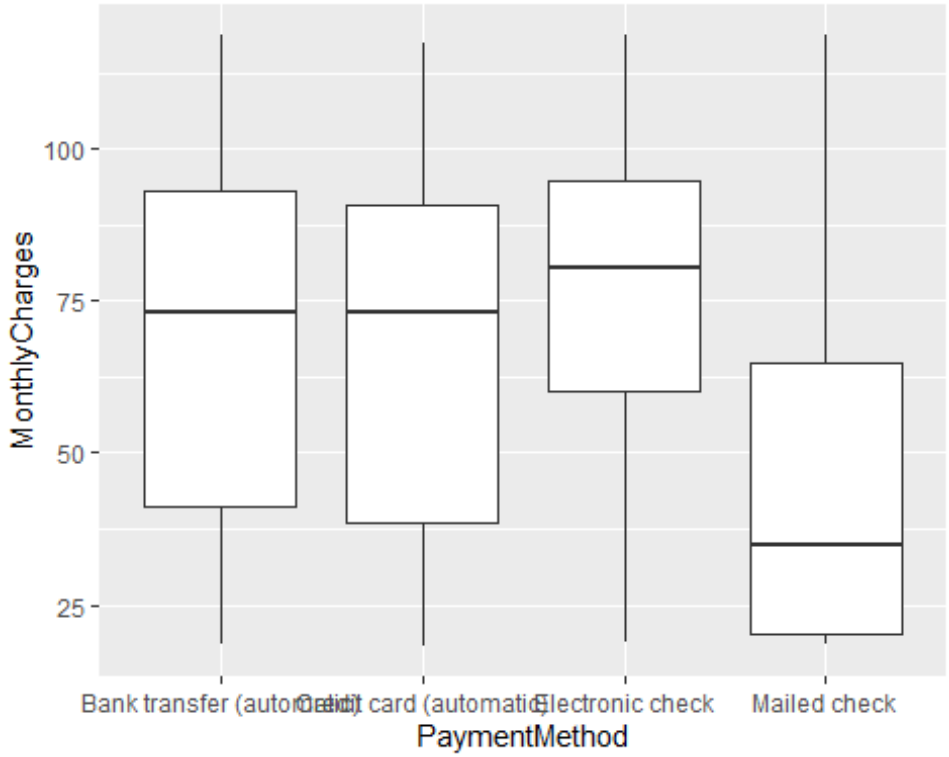



```
library(ggplot2)
ggplot(telecom,aes(x=gender,y=Partner))+geom_boxplot()
```

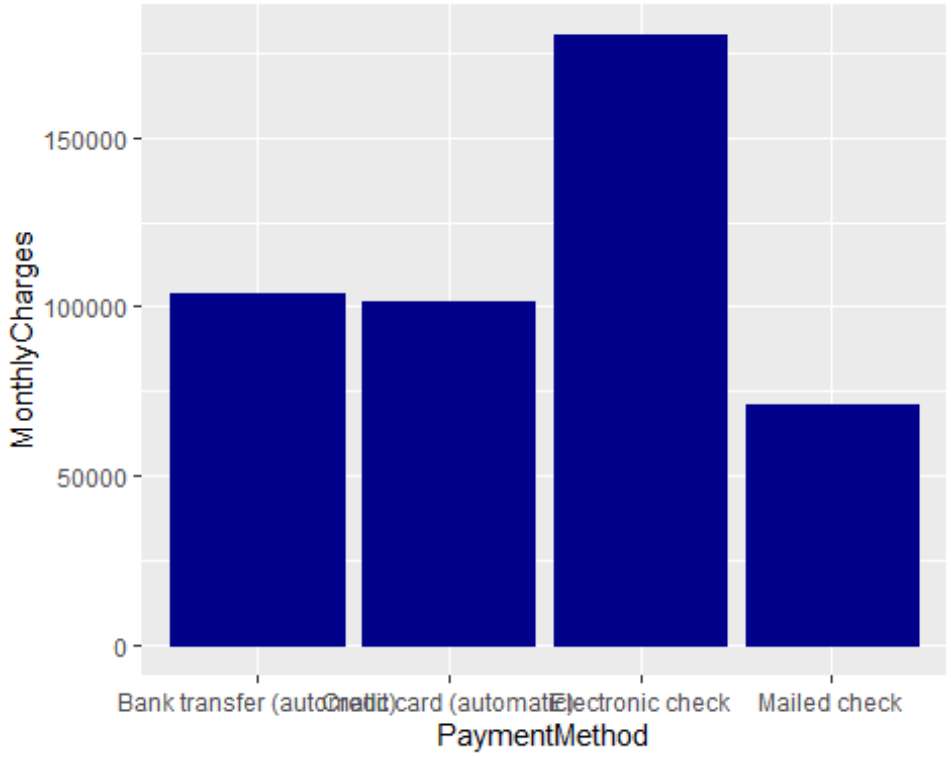

```
library(ggplot2)
ggplot(telecom,aes(x=gender,y=MonthlyCharges))+geom_boxplot()
```



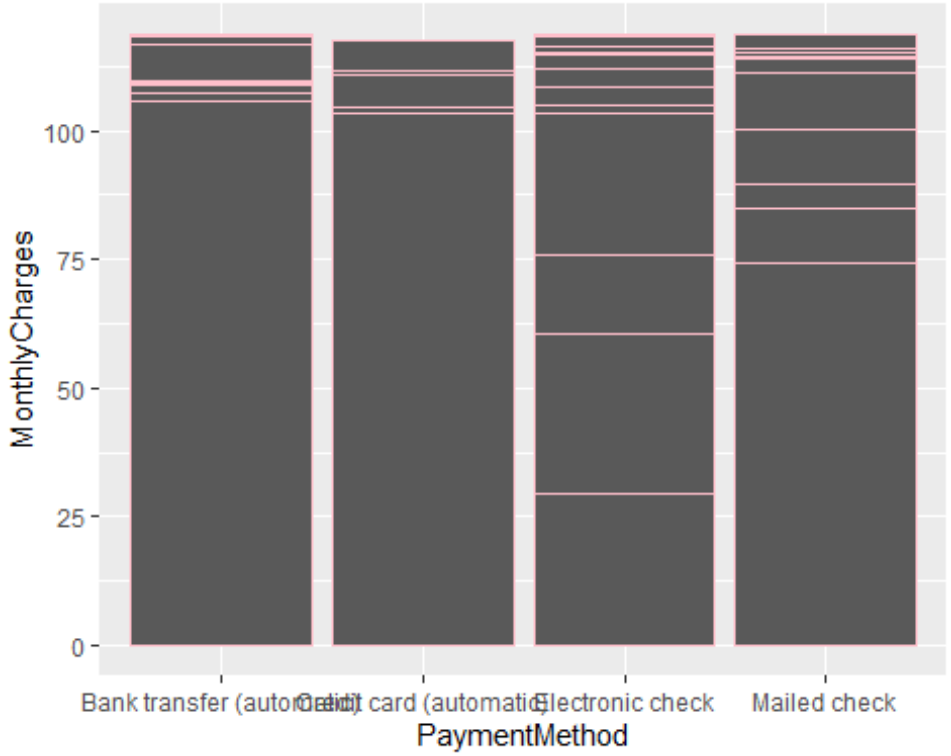
```
library(ggplot2)
ggplot(telecom,aes(x=PaymentMethod,y=MonthlyCharges))+geom_boxplot()
```



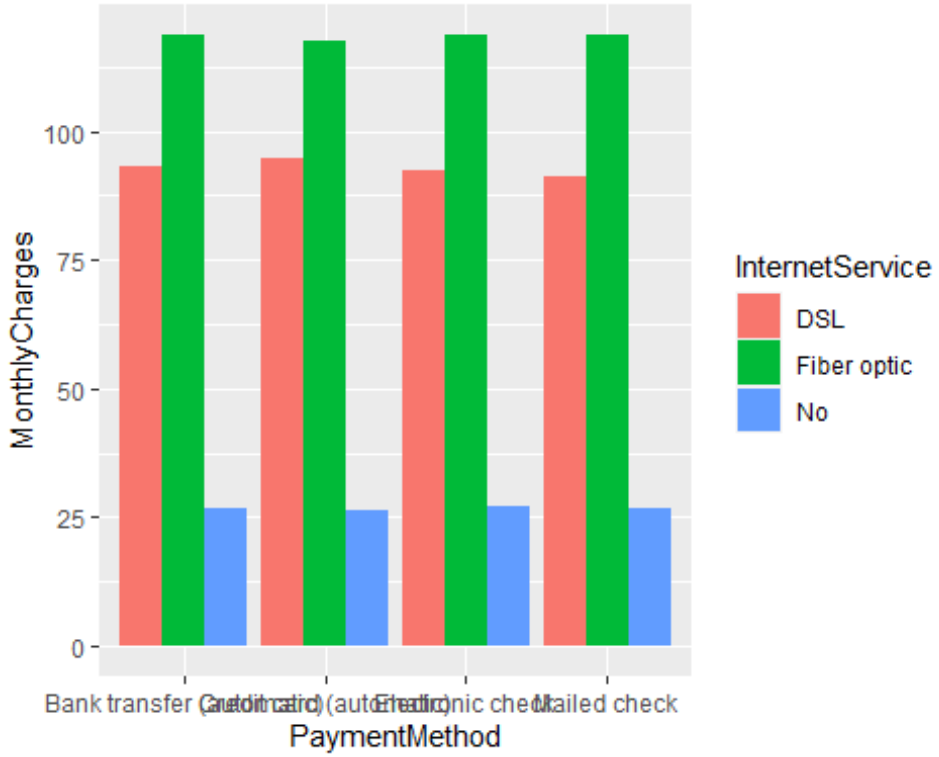

```
ggplot(telecom,aes(x=PaymentMethod,y=MonthlyCharges))+geom_col(colour="darkblue")
```



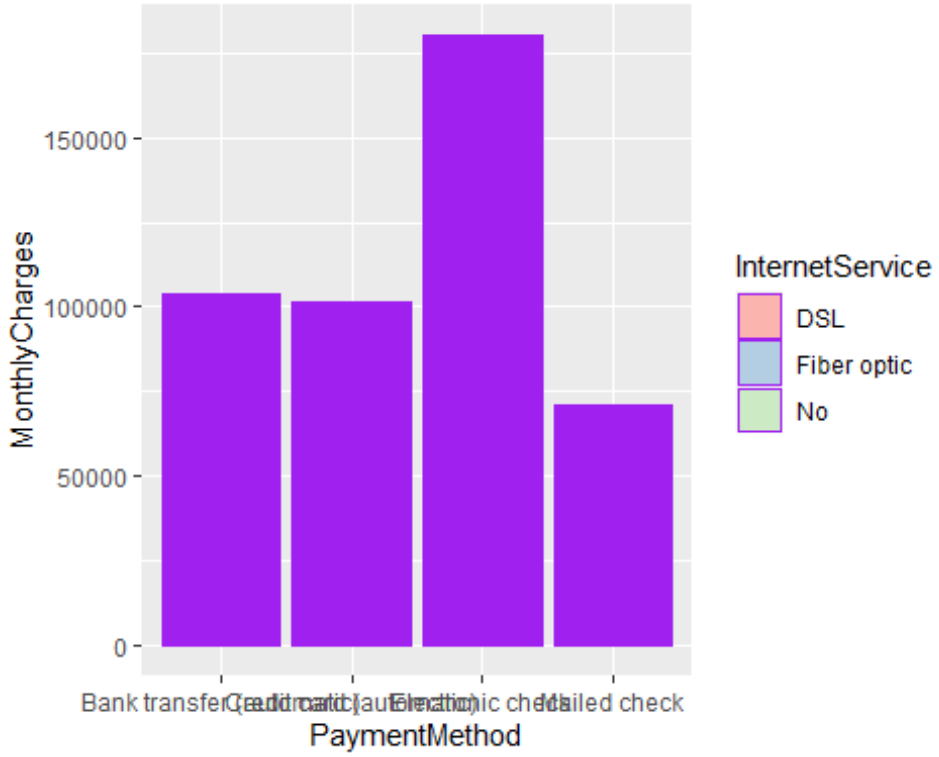

```
library(gcookbook)
ggplot(telecom,aes(x=PaymentMethod,y=MonthlyCharges))+geom_col(position="dodge",colour="pink")
```



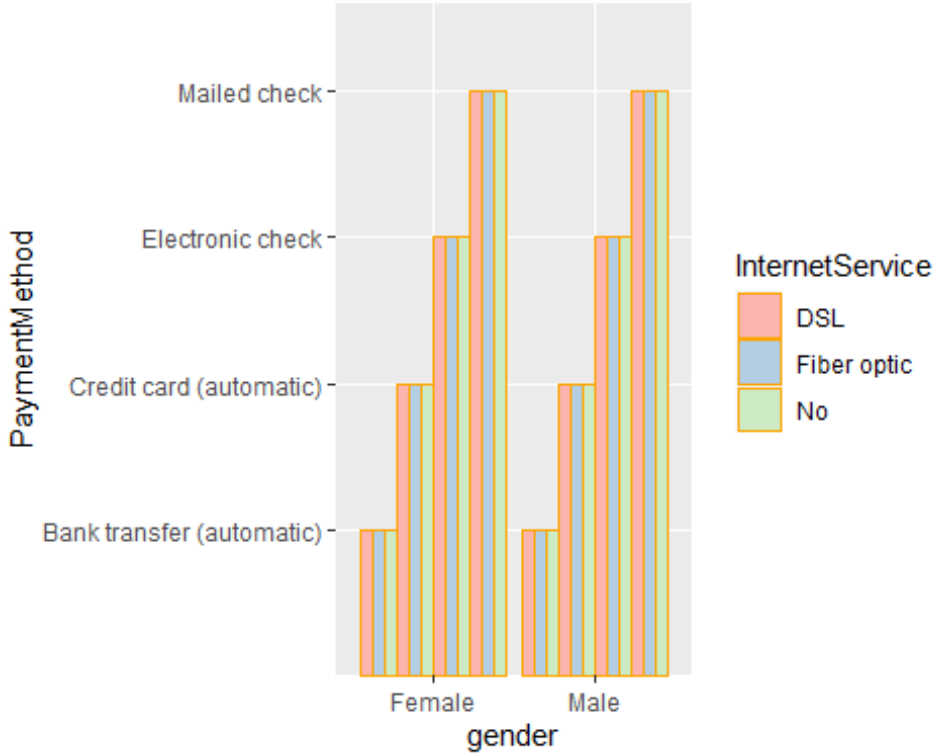
```
ggplot(telecom,aes(x=PaymentMethod,y=MonthlyCharges, fill=InternetService ))+
geom_col(position="dodge")
```



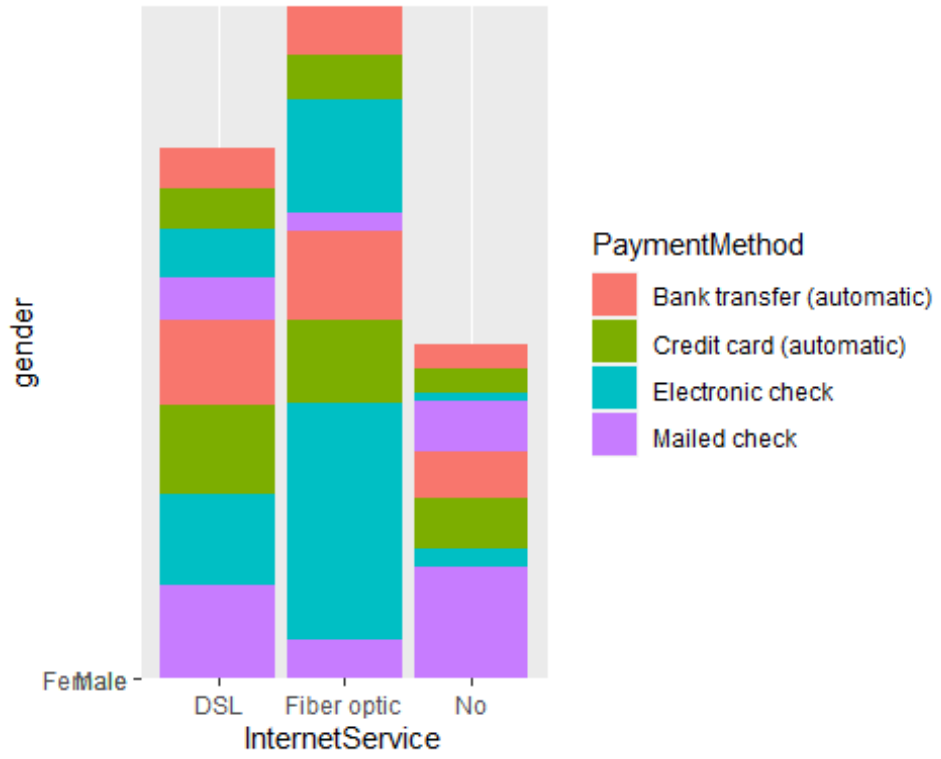

```
ggplot(telecom,aes(x=PaymentMethod,y=MonthlyCharges,fill=InternetService))+ge
om_col(colour="purple")+scale_fill_brewer(palette="Pastel1")
```




```
ggplot(telecom,aes(x=gender,y=PaymentMethod,fill=InternetService))+geom_col(p
osition="dodge",colour="orange")+scale_fill_brewer(palette="Pastel1")
```

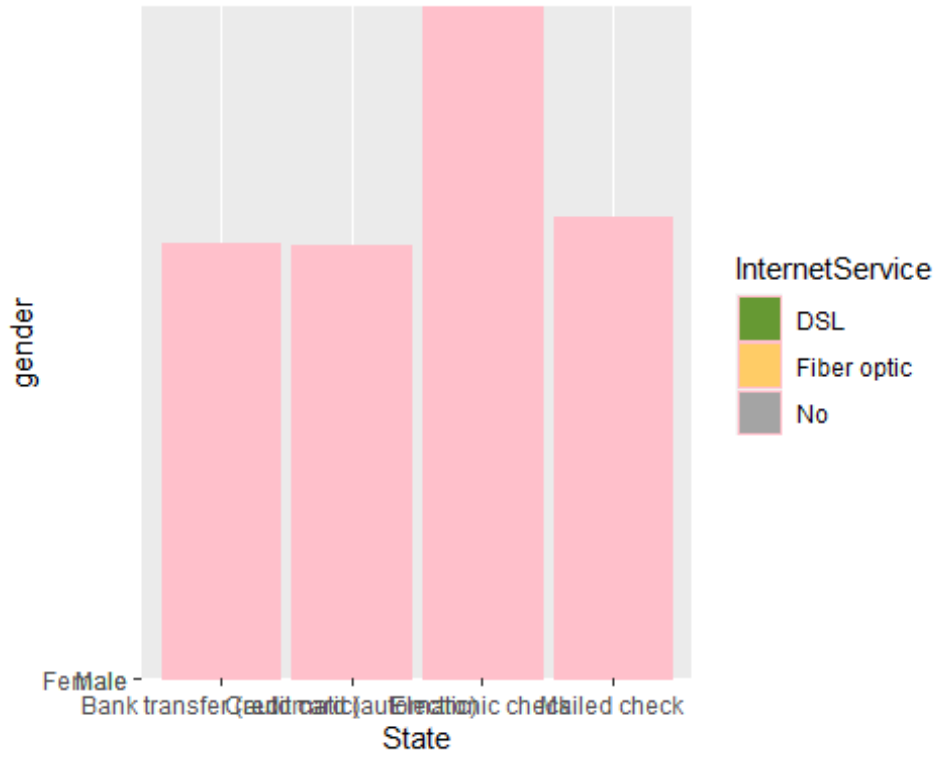


```
ggplot(telecom,aes(x=InternetService,y=gender,fill=PaymentMethod))+geom_col()
```




```
ggplot(telecom,aes(x=reorder(PaymentMethod,gender),y=gender,fill=InternetServ
ice))+geom_col(colour="pink")+scale_fill_manual(values=c('#669933','#FFCC66',
"#A4A4A4"))+xlab("State")

## Warning in mean.default(X[[i]], ...): argument is not numeric or logical:
## returning NA

## Warning in mean.default(X[[i]], ...): argument is not numeric or logical:
## returning NA

## Warning in mean.default(X[[i]], ...): argument is not numeric or logical:
## returning NA

## Warning in mean.default(X[[i]], ...): argument is not numeric or logical:
## returning NA

## Warning in mean.default(X[[i]], ...): argument is not numeric or logical:
## returning NA

## Warning in mean.default(X[[i]], ...): argument is not numeric or logical:
## returning NA

## Warning in mean.default(X[[i]], ...): argument is not numeric or logical:
## returning NA
```

```
## Warning in mean.default(X[[i]], ...): argument is not numeric or logical:
## returning NA
```

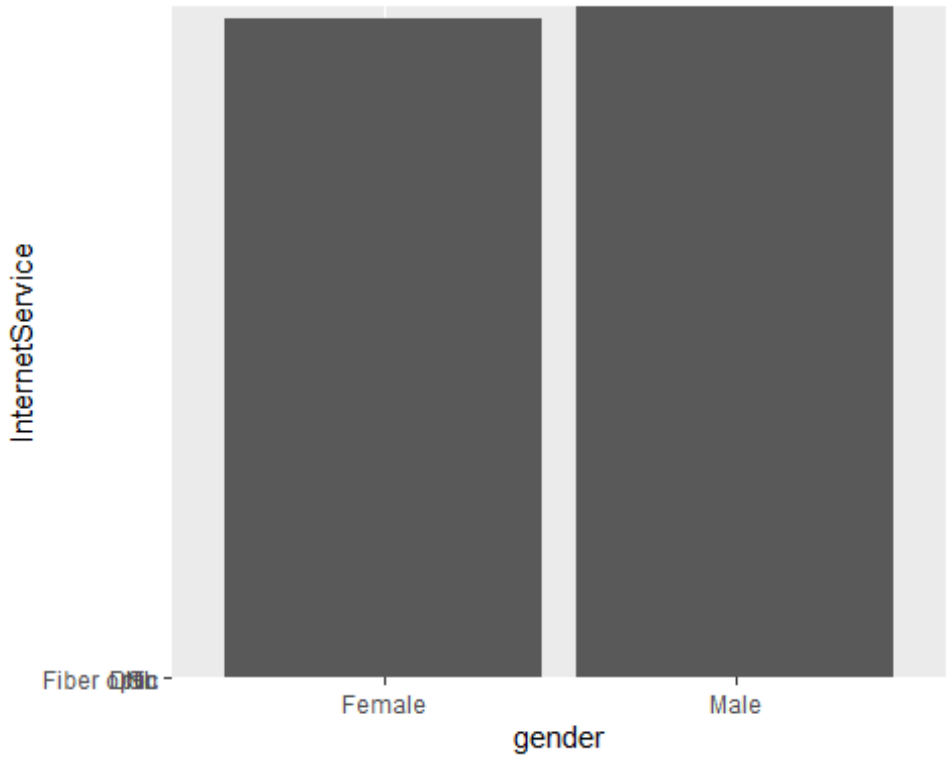



```
ggplot(telecom,aes(x=reorder(PaymentMethod,gender),y=gender,fill=InternetServ
ice))+geom_col(position="identity")
```

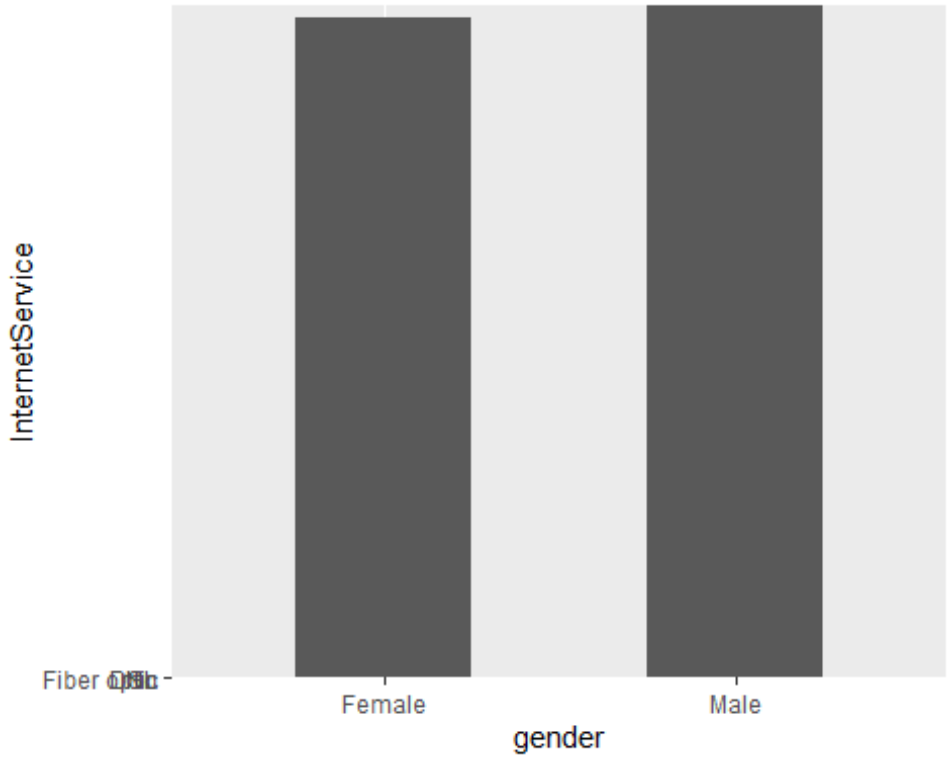
```
## Warning in mean.default(X[[i]], ...): argument is not numeric or logical:
## returning NA

## Warning in mean.default(X[[i]], ...): argument is not numeric or logical:
## returning NA

## Warning in mean.default(X[[i]], ...): argument is not numeric or logical:
## returning NA

## Warning in mean.default(X[[i]], ...): argument is not numeric or logical:
## returning NA

## Warning in mean.default(X[[i]], ...): argument is not numeric or logical:
## returning NA

## Warning in mean.default(X[[i]], ...): argument is not numeric or logical:
## returning NA

## Warning in mean.default(X[[i]], ...): argument is not numeric or logical:
## returning NA
```

```
## Warning in mean.default(X[[i]], ...): argument is not numeric or logical:
## returning NA
```

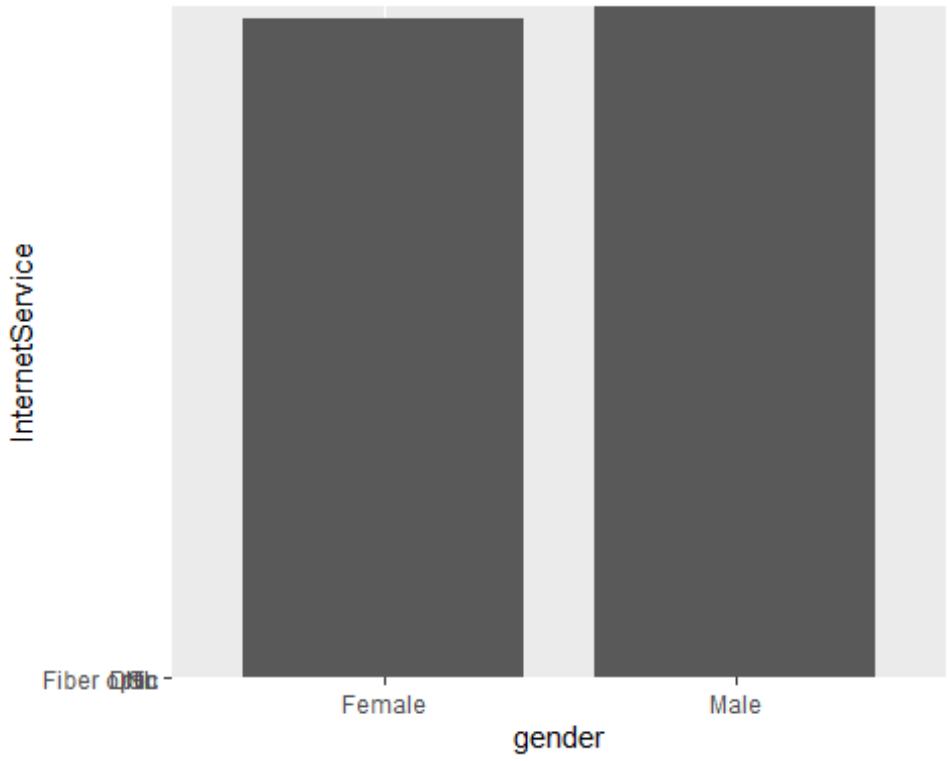

```
#adjusting bar width and spacing
library(gcookbook)
ggplot(telecom,aes(x=gender,y=InternetService))+geom_col()
```



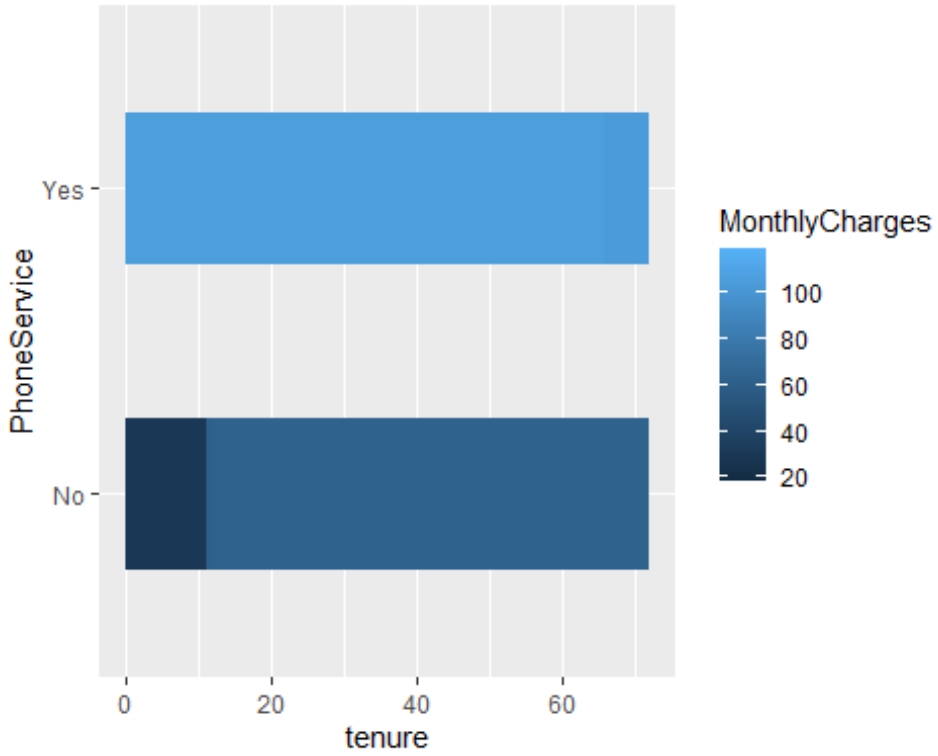

```
ggplot(telecom,aes(x=gender,y=InternetService))+geom_col(width=0.5)
```



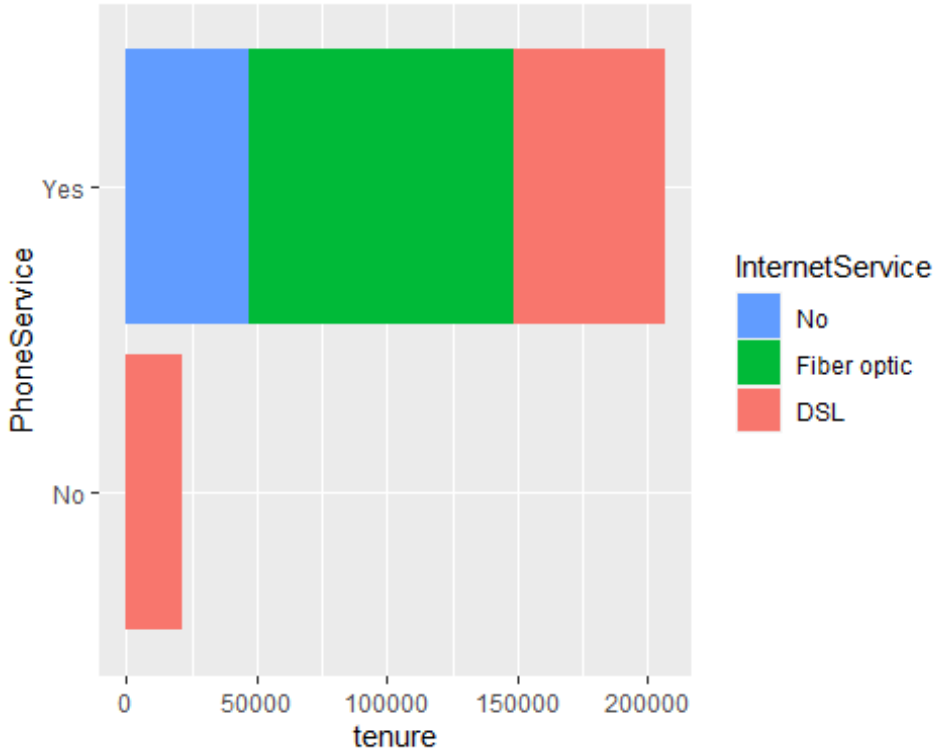

```
ggplot(telecom,aes(x=gender,y=InternetService))+geom_col(width=0.8)
```



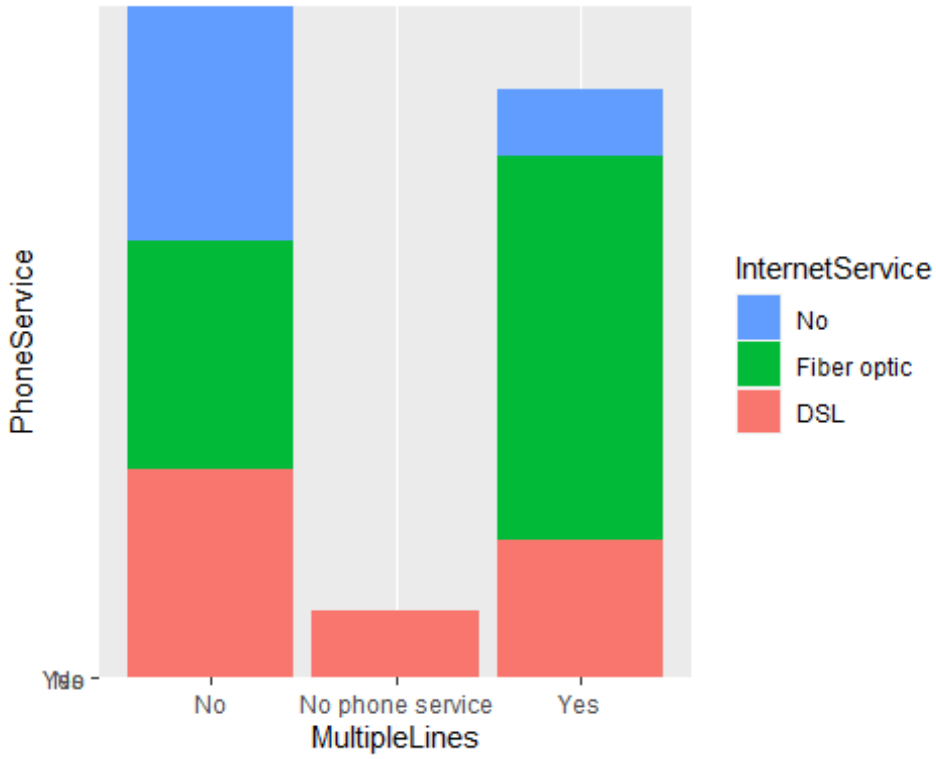

```
ggplot(telecom,aes(x=tenure,y=PhoneService,fill=MonthlyCharges))+geom_col(wid
th=0.5,position=position_dodge(0.5))
```



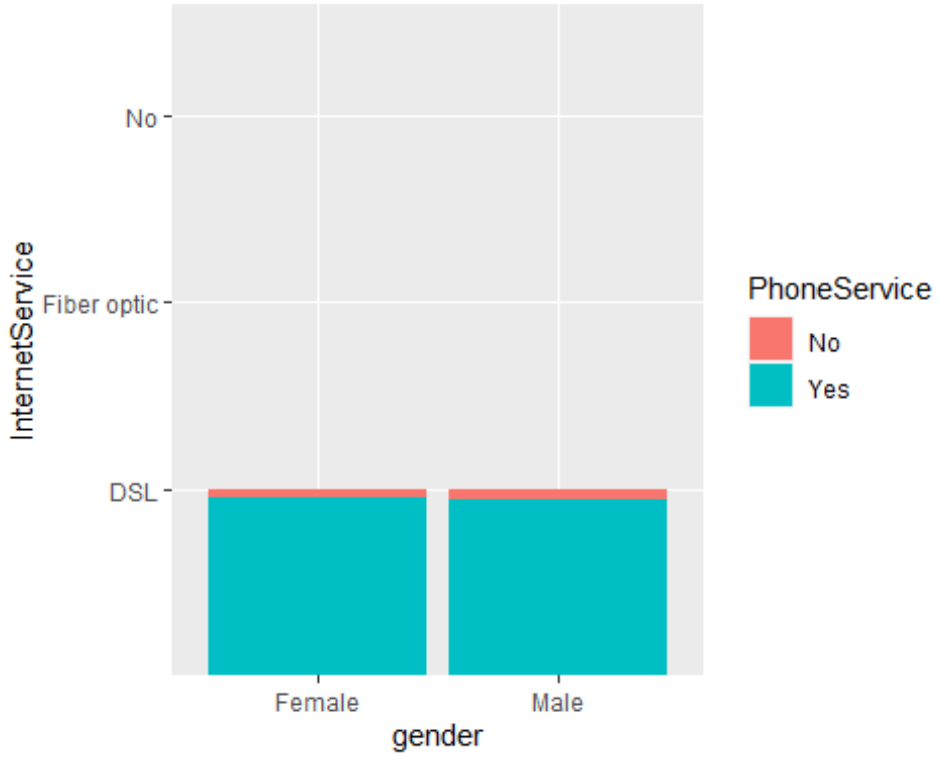
```
ggplot(telecom,aes(x=tenure,y=PhoneService,fill=InternetService))+geom_col()+
guides(fill=guide_legend(reverse=TRUE))
```



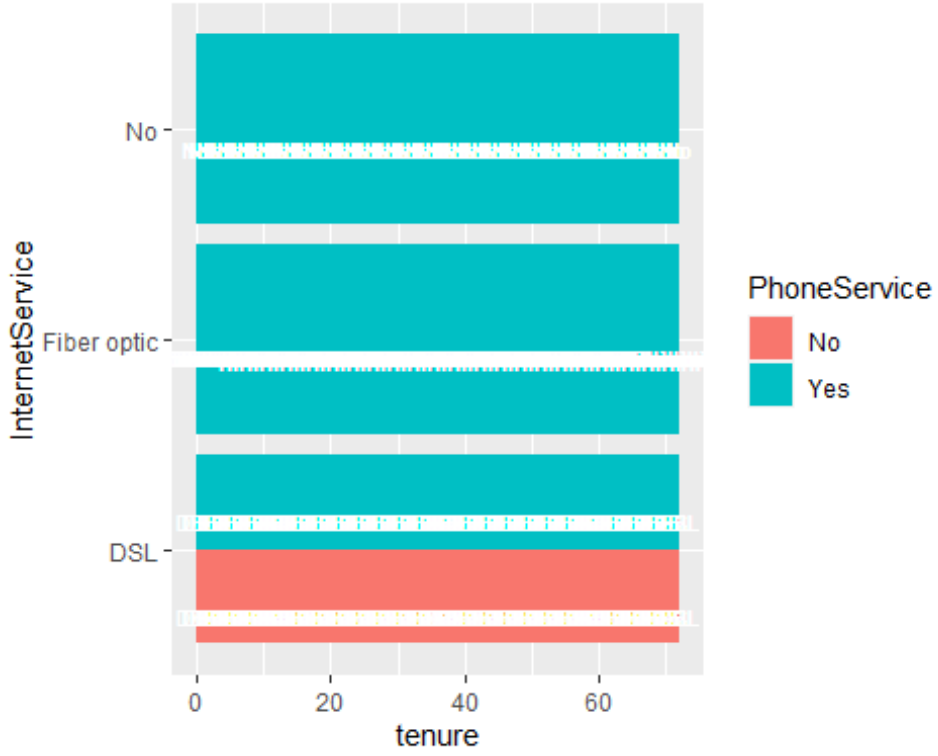

```
ggplot(telecom,aes(x=MultipleLines,y=PhoneService,fill=InternetService))+geom
_col(position=position_stack(reverse=TRUE))+guides(fill=guide_legend(reverse=
TRUE))
```



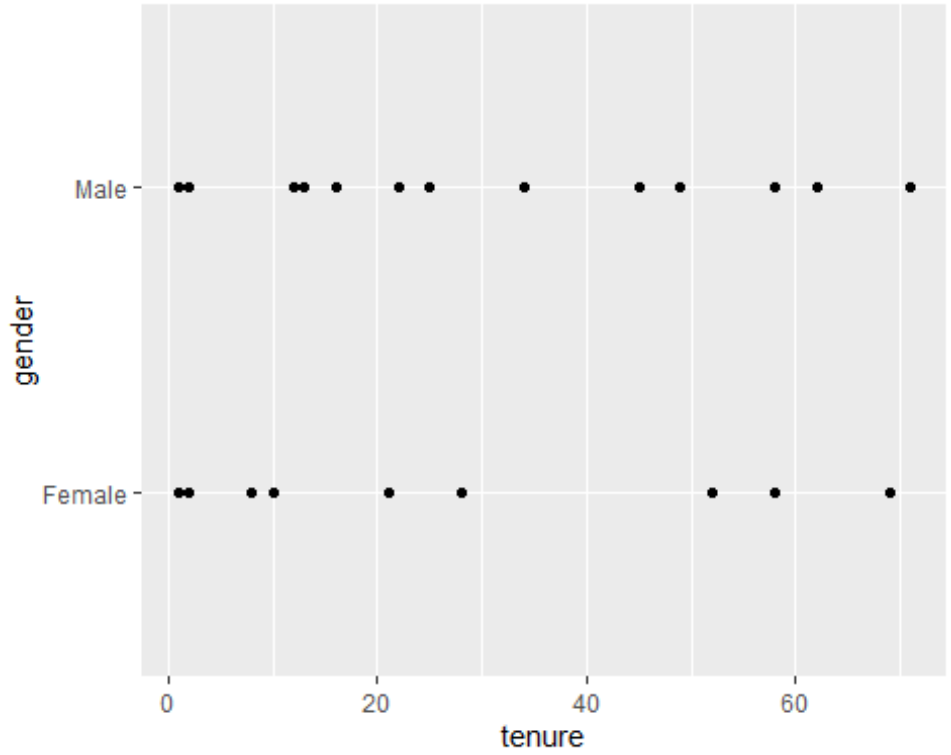

```
##stacked bar graphs
library(gcookbook)
ggplot(telecom,aes(x=gender,y=InternetService,fill=PhoneService))+geom_col(po
sition="fill")
```




```
ggplot(telecom,aes(x=tenure,y=InternetService,fill=PhoneService))+geom_col(position="dodge")+geom_text(aes(label=InternetService),colour="white",size=3,vjust=1.5,position=position_dodge(.9))
```

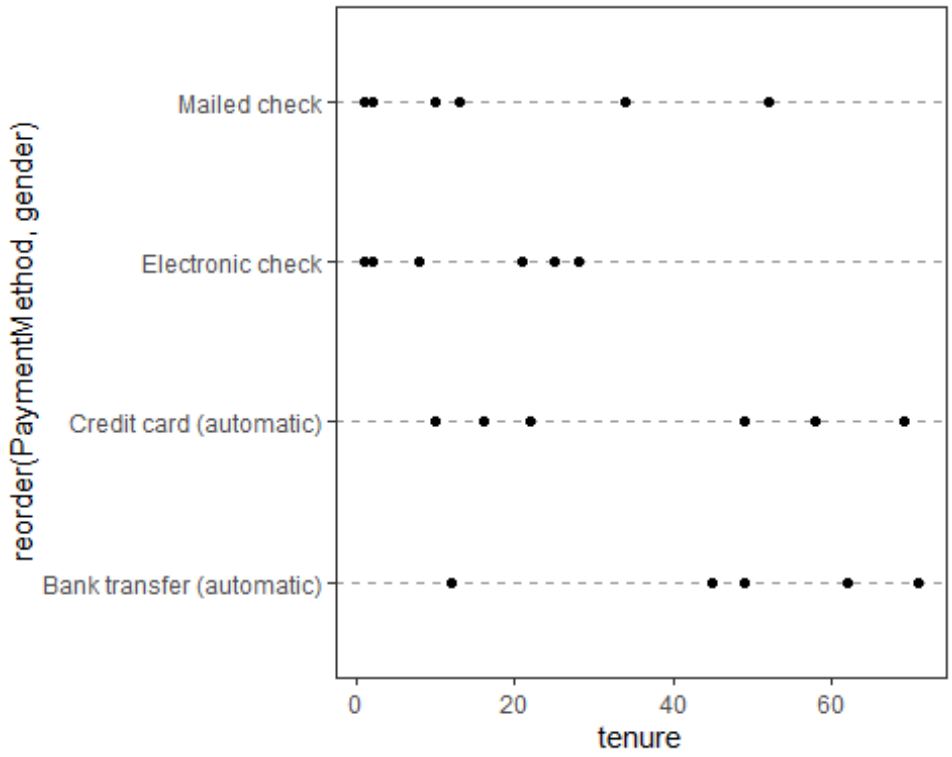


```
library(gcookbook)
telecom<-telecom[1:25,]
ggplot(telecom,aes(x=tenure,y=gender))+geom_point()
```




```
ggplot(telecom,aes(x=tenure,y=reorder(PaymentMethod,gender)))+geom_point(tenure=3)+theme_bw()+
  theme( panel.grid.major.x=element_blank(),panel.grid.minor.x=element_blank(),panel.grid.major.y=element_line(colour="grey60",linetype="dashed"))
```

```
## Warning in geom_point(tenure = 3): Ignoring unknown parameters: `tenure`
## argument is not numeric or logical: returning NA
## argument is not numeric or logical: returning NA
## argument is not numeric or logical: returning NA
## argument is not numeric or logical: returning NA
## argument is not numeric or logical: returning NA
## argument is not numeric or logical: returning NA
## argument is not numeric or logical: returning NA
## argument is not numeric or logical: returning NA
```




```
ggplot(telecom,aes(x=reorder(tenure,gender),y=InternetService))+geom_point(si
ze=3)+theme_bw()+theme( panel.grid.major.y=element_blank(),panel.grid.minor.y
=element_blank(),panel.grid.major.x=element_line(colour="grey60",linetype="da
shed"))
```

```
## Warning in mean.default(X[[i]], ...): argument is not numeric or logical:
## returning NA

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## returning NA

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## Warning in mean.default(X[[i]], ...): argument is not numeric or logical:
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## Warning in mean.default(X[[i]], ...): argument is not numeric or logical:
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```

```
## Warning in mean.default(X[[i]], ...): argument is not numeric or logical:
## returning NA

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## returning NA

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## returning NA

## Warning in mean.default(X[[i]], ...): argument is not numeric or logical:
## returning NA

## Warning in mean.default(X[[i]], ...): argument is not numeric or logical:
## returning NA

## Warning in mean.default(X[[i]], ...): argument is not numeric or logical:
## returning NA

## Warning in mean.default(X[[i]], ...): argument is not numeric or logical:
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```

```
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## returning NA

## Warning in mean.default(X[[i]], ...): argument is not numeric or logical:
## returning NA

## Warning in mean.default(X[[i]], ...): argument is not numeric or logical:
## returning NA
```
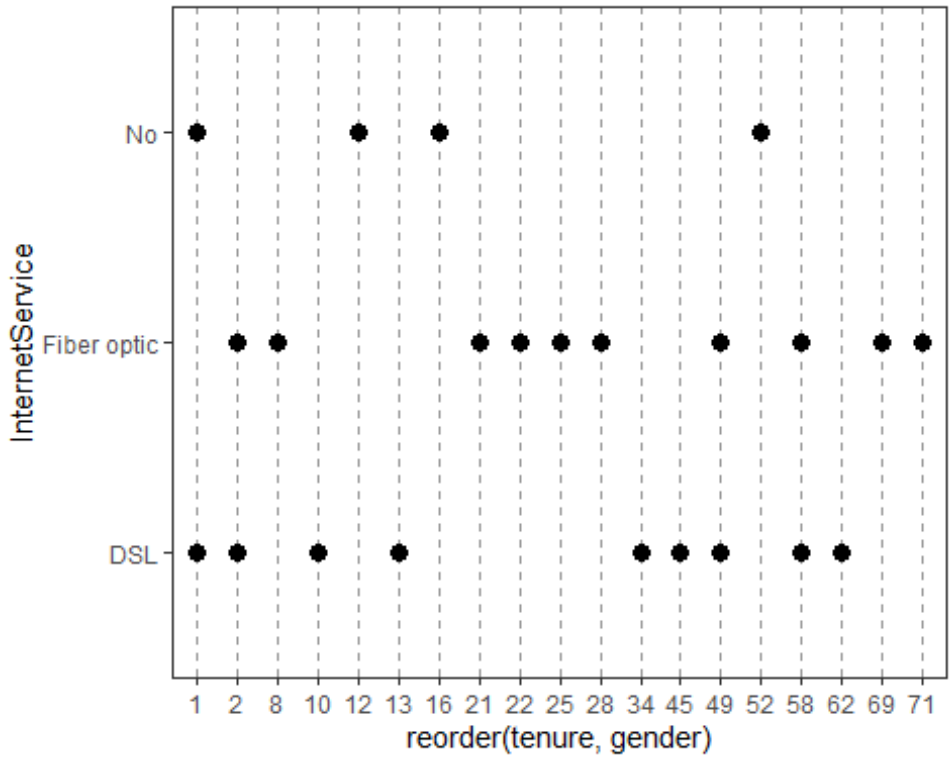
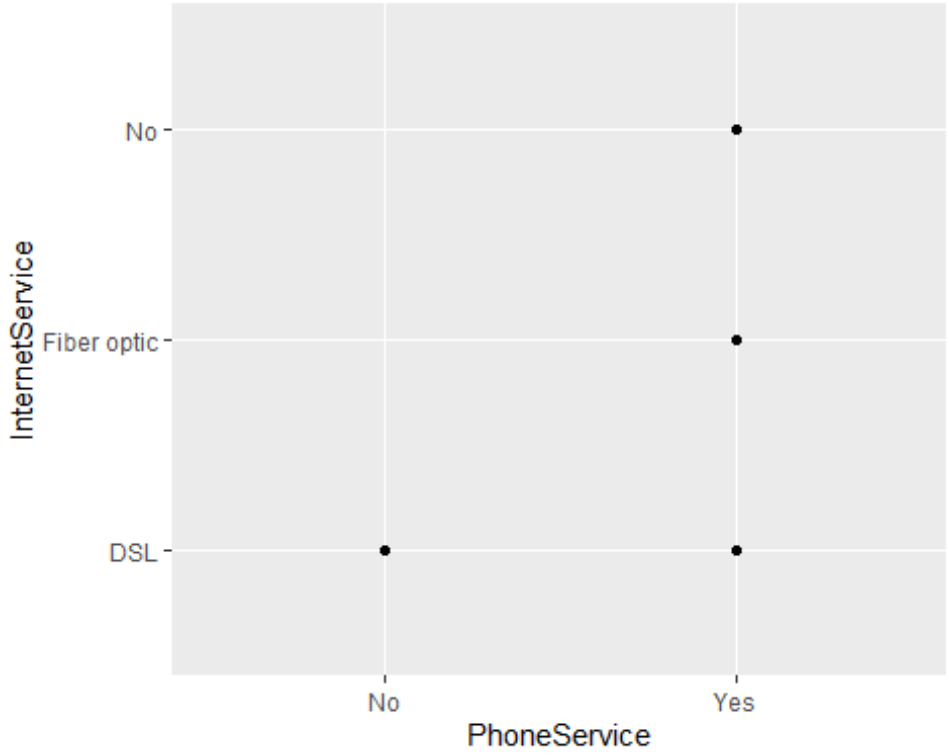
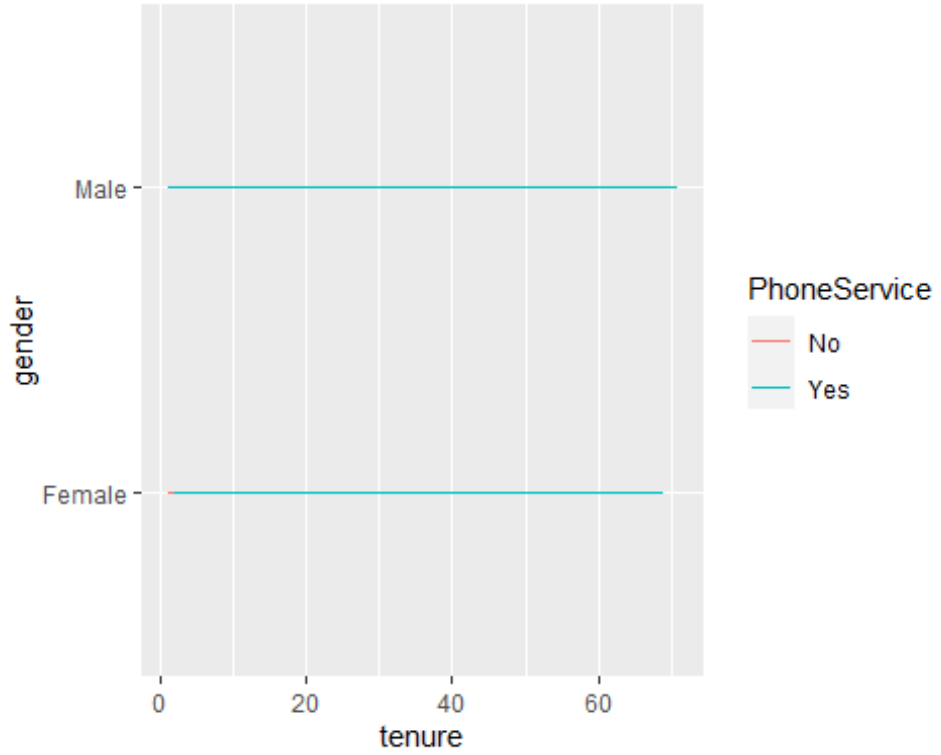



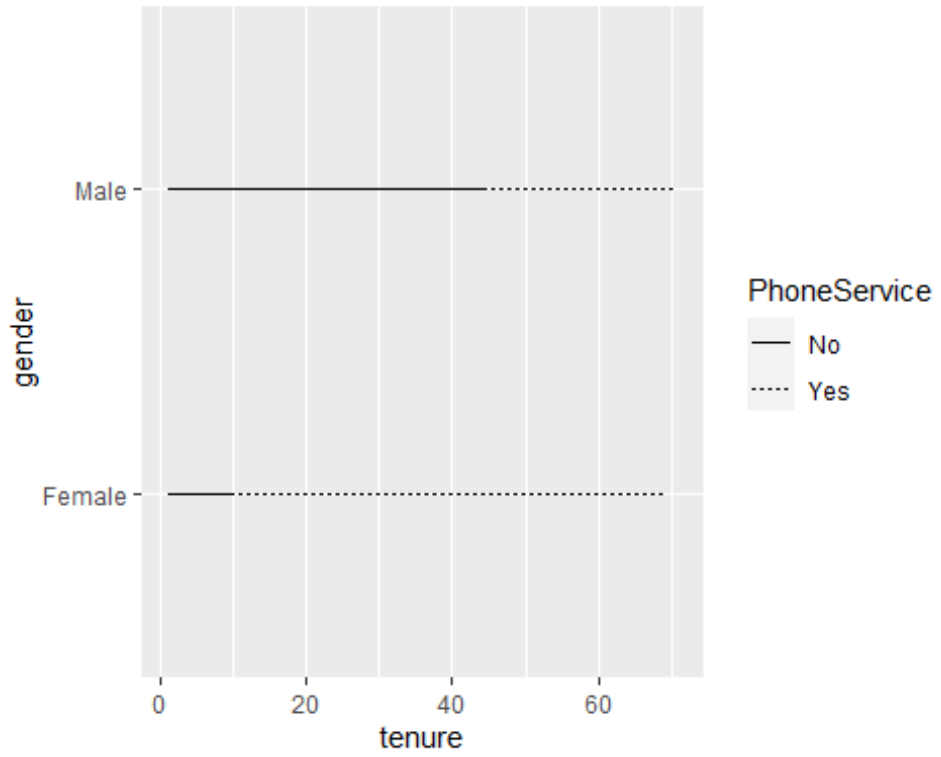

```
ggplot(telecom,aes(x=PhoneService,y=InternetService))+geom_line()+geom_point(
)
```



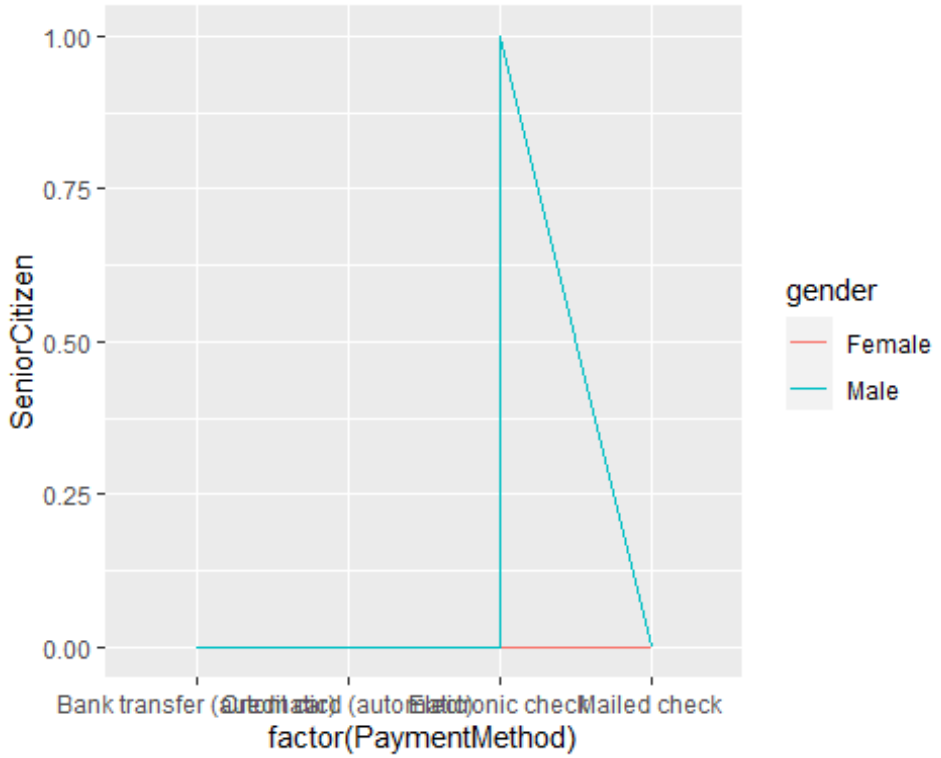
```
library(gcookbook)
ggplot(telecom,aes(x=tenure,y=gender,colour=PhoneService))+geom_line()
```



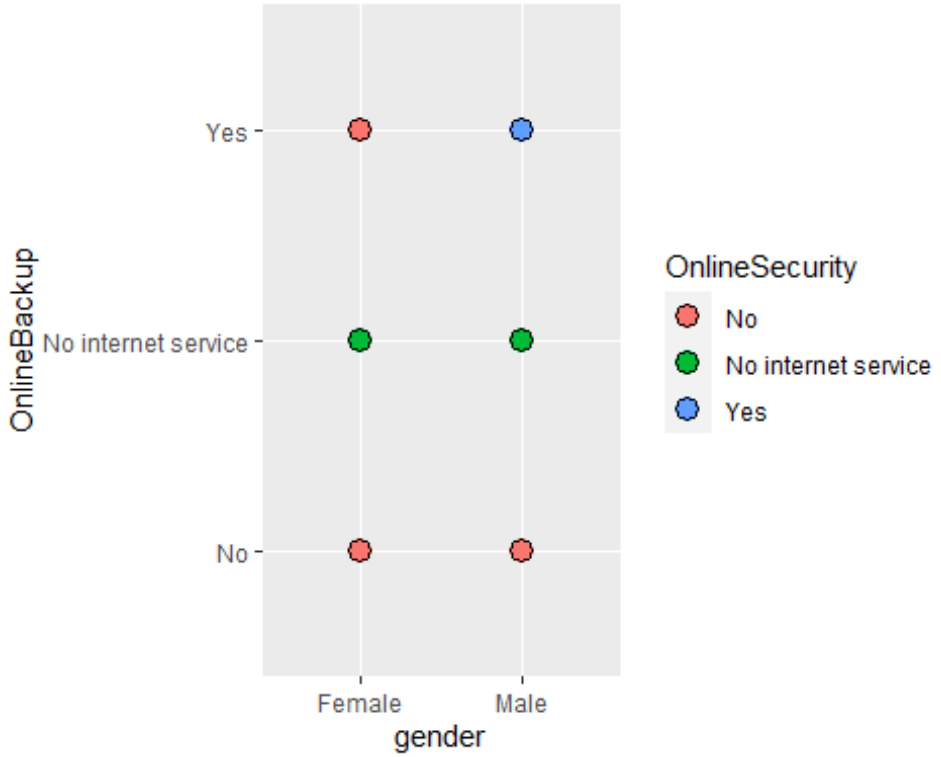

```
ggplot(telecom,aes(x=tenure,y=gender,linetype=PhoneService))+geom_line()
```



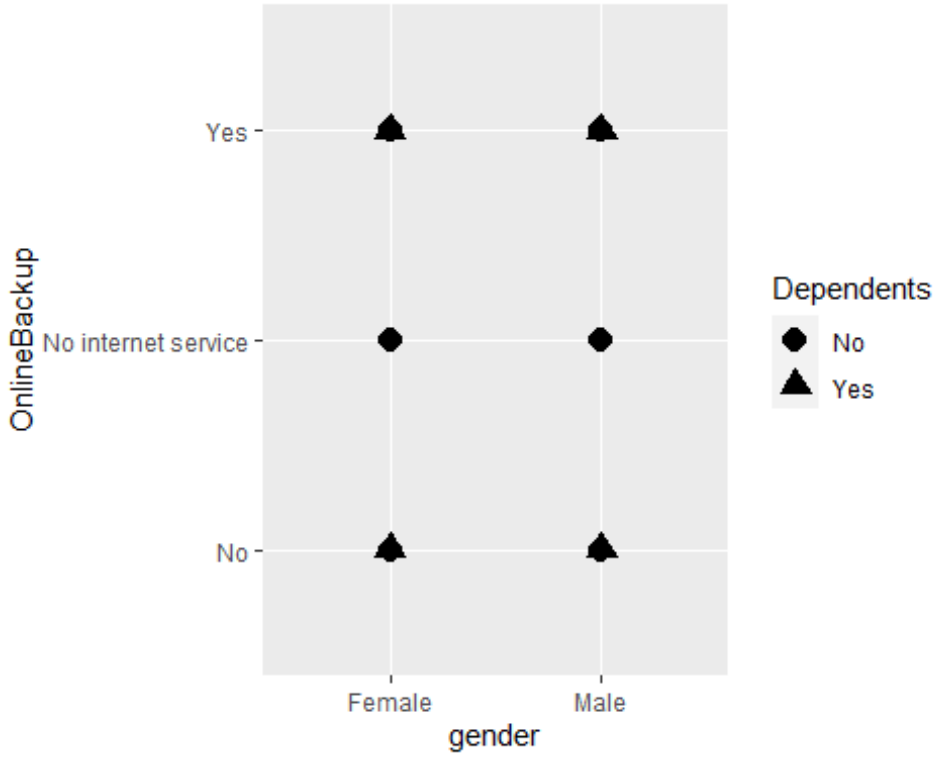

```
ggplot(telecom,aes(x=factor(PaymentMethod),y=SeniorCitizen,colour=gender,group=gender))+geom_line()
```



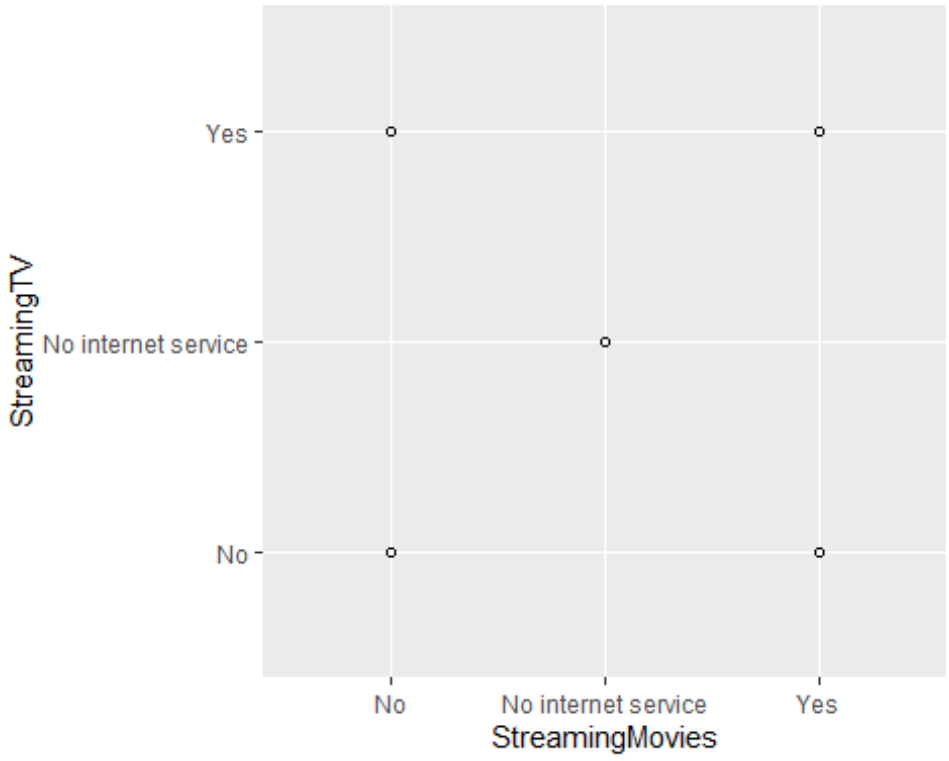
```
ggplot(telecom,aes(x=gender,y=OnlineBackup,fill=OnlineSecurity))+geom_line()+
geom_point(size=4,shape=21)
```



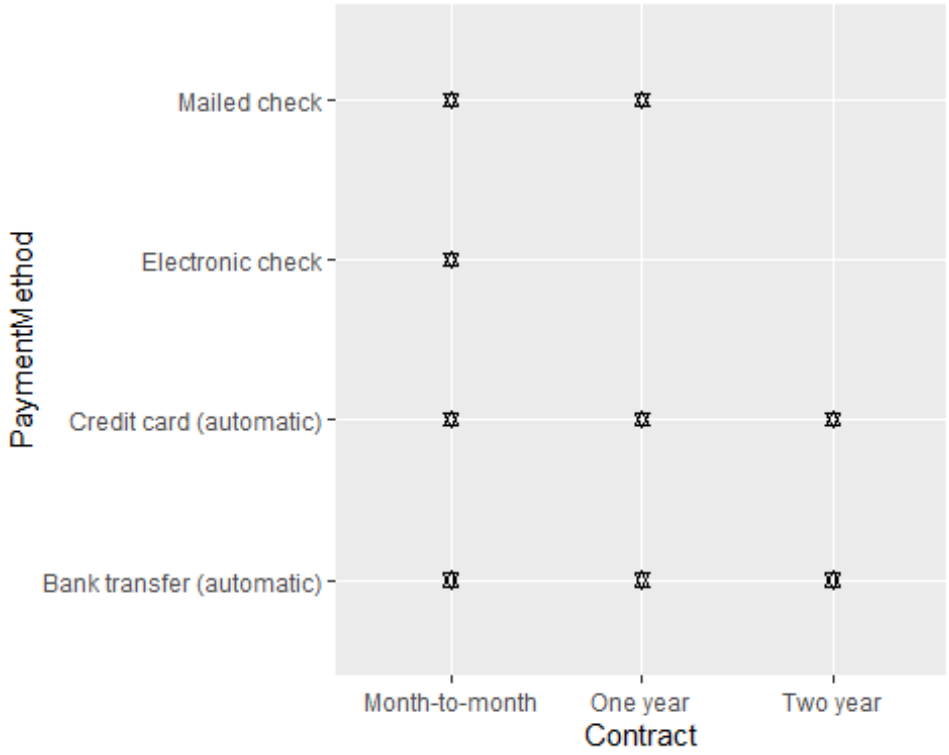

```
ggplot(telecom,aes(x=gender,y=OnlineBackup,shape=Dependents))+geom_line()+geo
m_point(size=4)
```



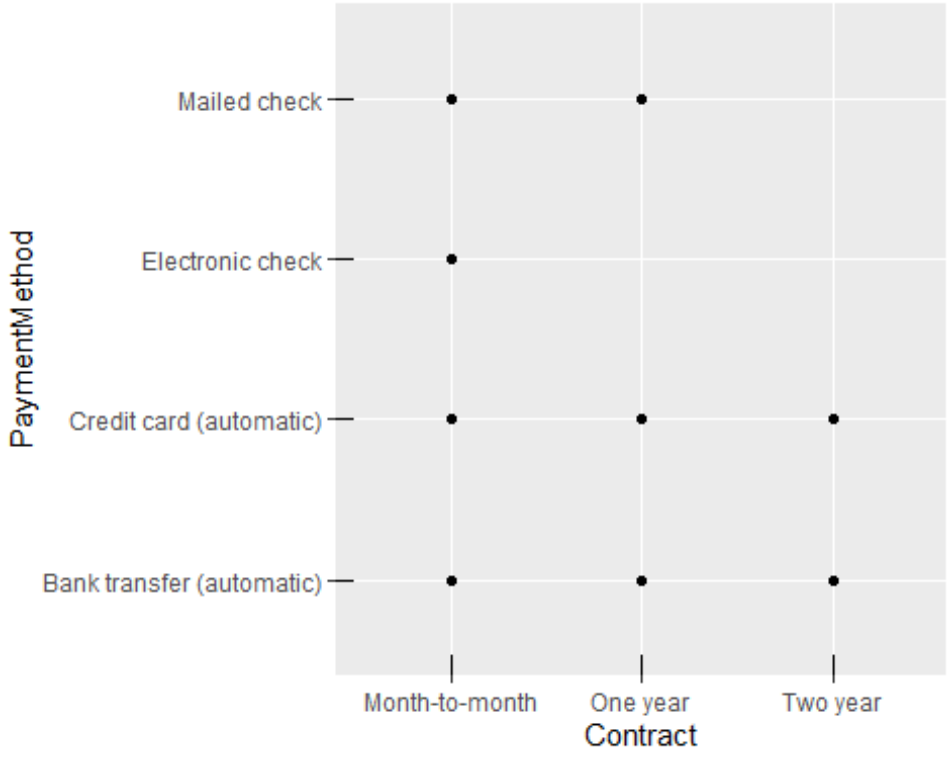

```
ggplot(telecom,aes(x=StreamingMovies,y=StreamingTV))+geom_point(shape=21)
```




```
ggplot(telecom,aes(x=Contract,y=PaymentMethod))+geom_point(shape=11)
```

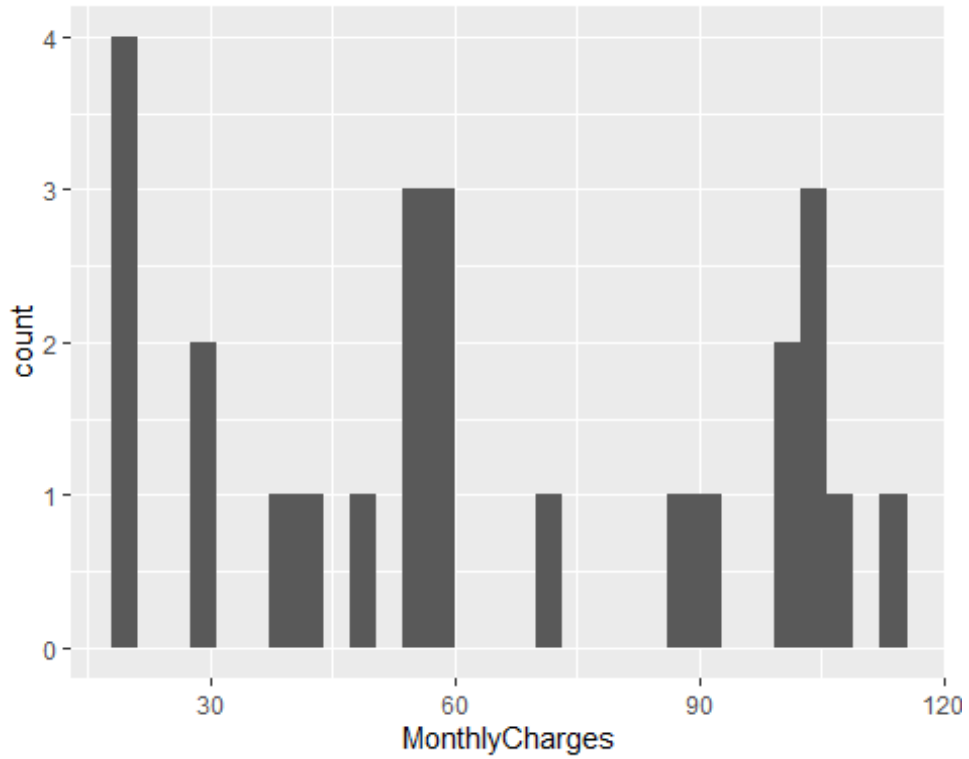



```
ggplot(telecom,aes(x=Contract,y=PaymentMethod))+geom_point()+geom_rug()
```

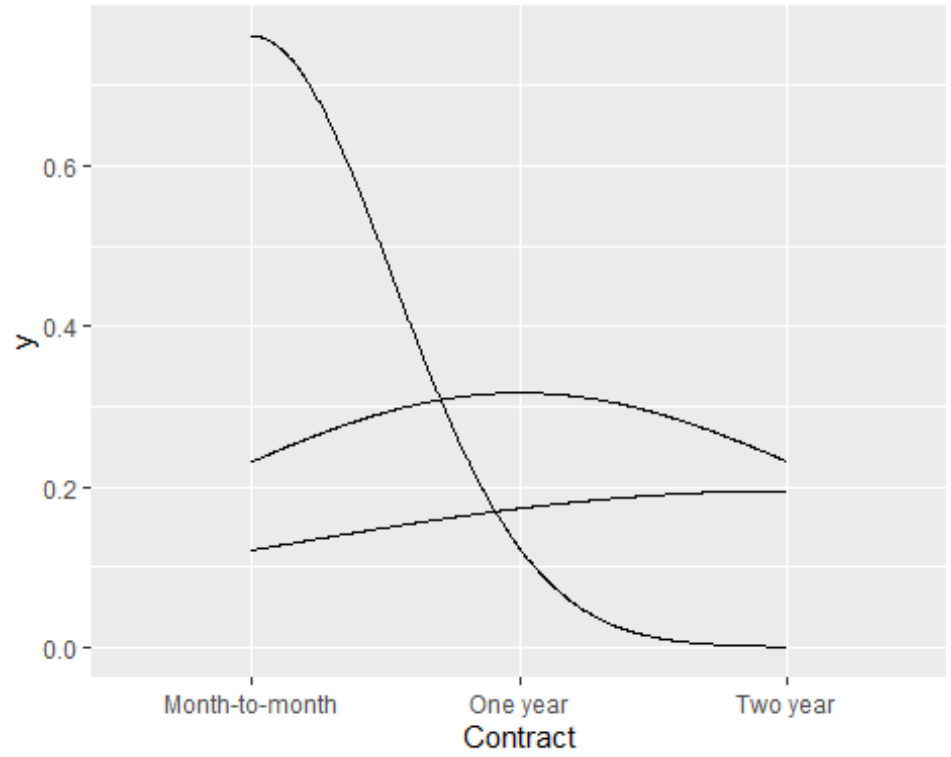



```
ggplot(telecom,aes(x=MonthlyCharges))+geom_histogram()
```

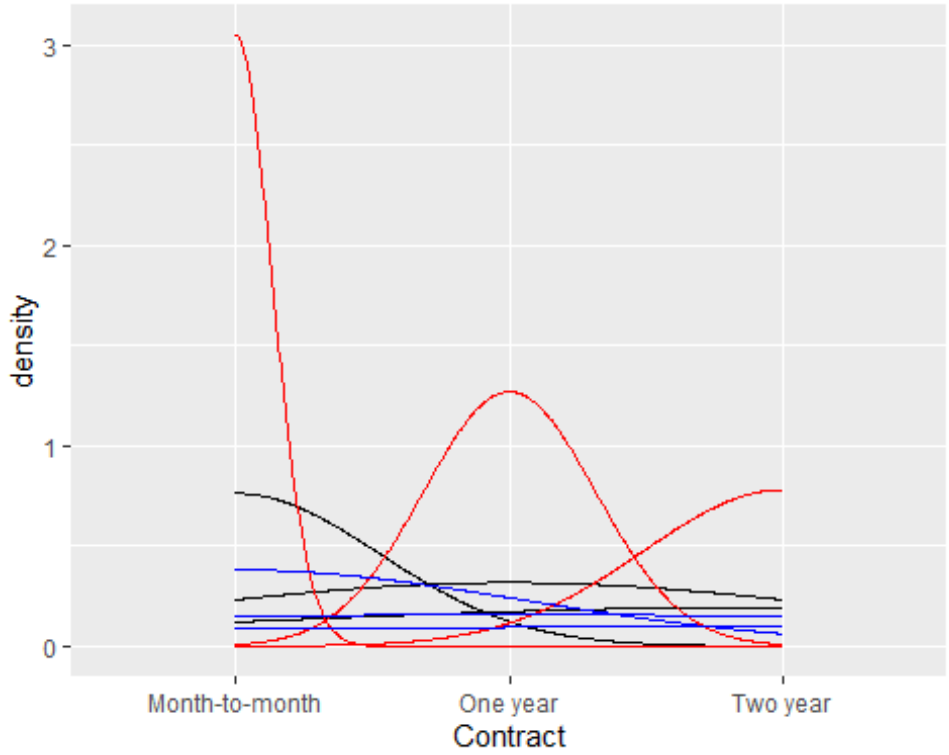
```
## `stat_bin()` using `bins = 30`. Pick better value with `binwidth`.
```



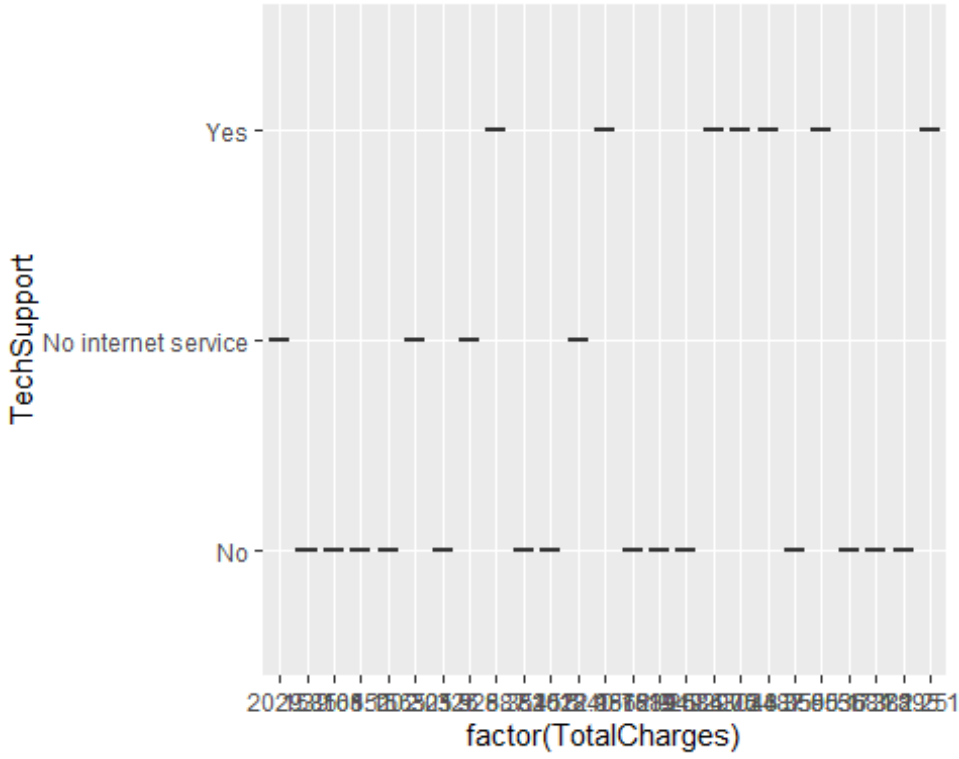

```
ggplot(telecom,aes(x=Contract))+geom_line(stat="density")+expand_limits(y=0)
```



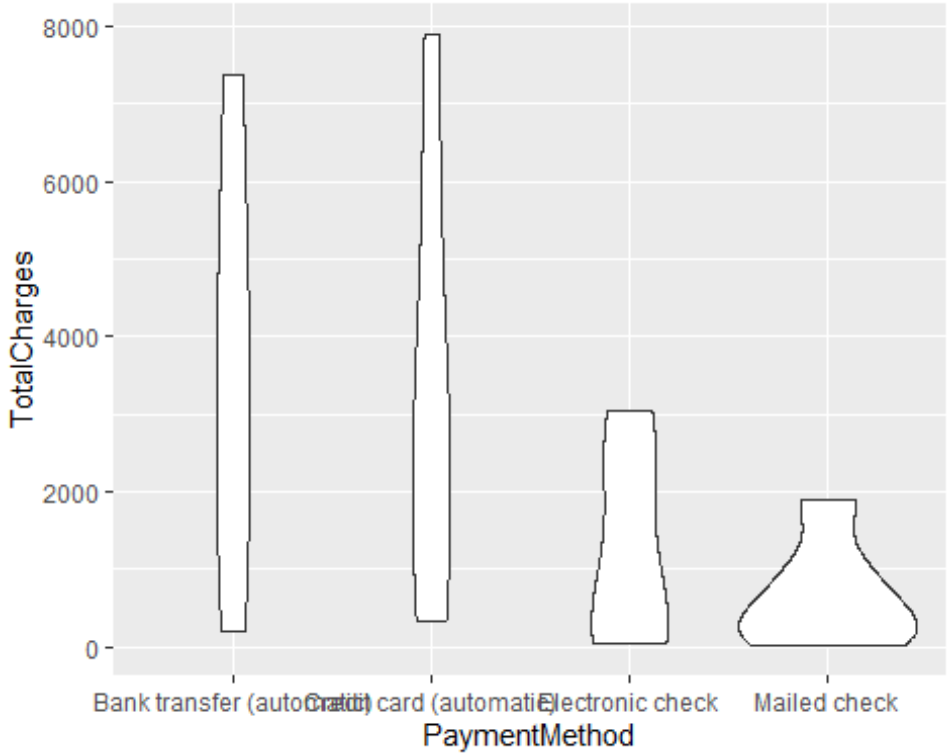
```
ggplot(telecom,aes(x=Contract))+geom_line(stat="density")+geom_line(stat="den
sity",adjust=.25,colour="red")+geom_line(stat="density",adjust=2,colour="blue
")
```



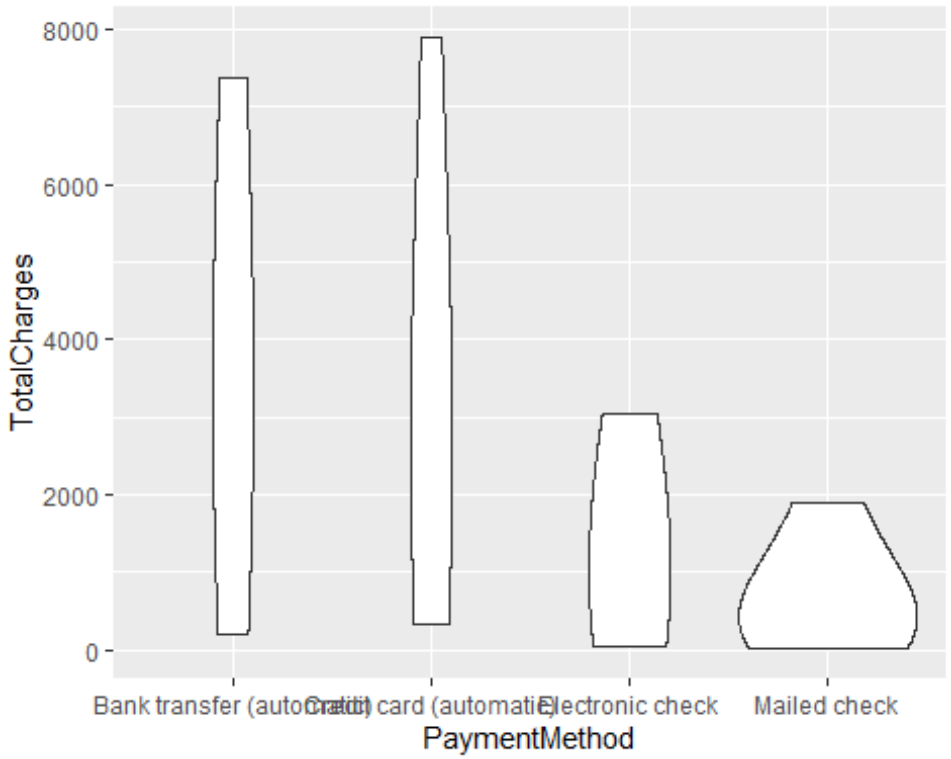

```
library(MASS)
ggplot(telecom,aes(x=factor(TotalCharges),y=TechSupport))+geom_boxplot()
```




```
library(gcookbook)
telecom<-ggplot(telecom,aes(x=PaymentMethod,y=TotalCharges))
telecom+geom_violin()
```

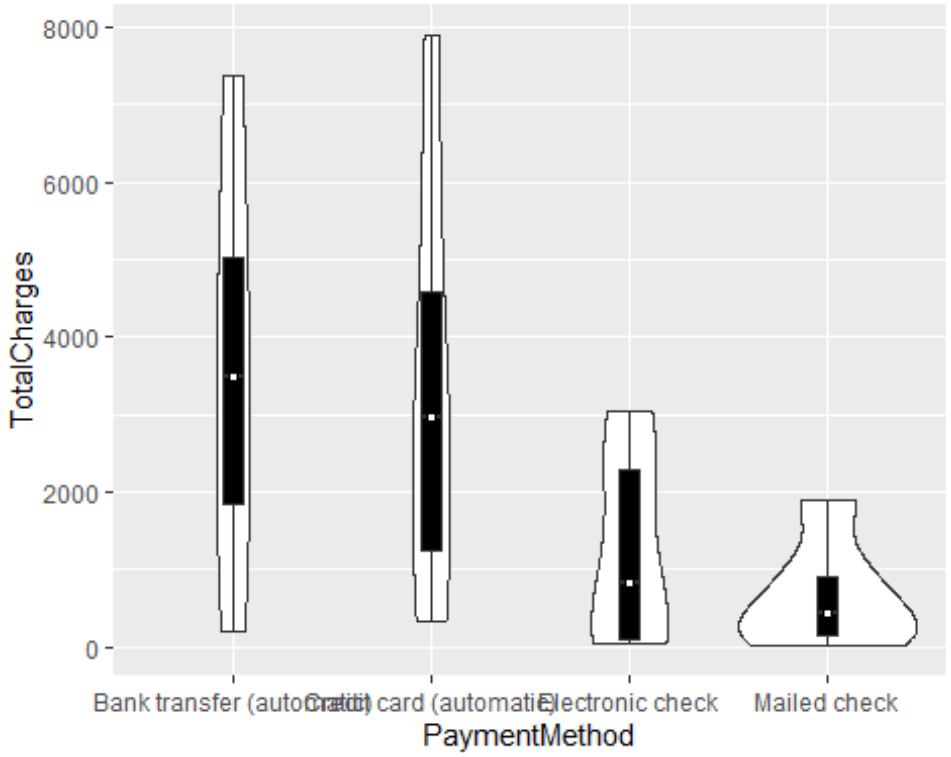


```
telecom+geom_violin(adjust=2)
```

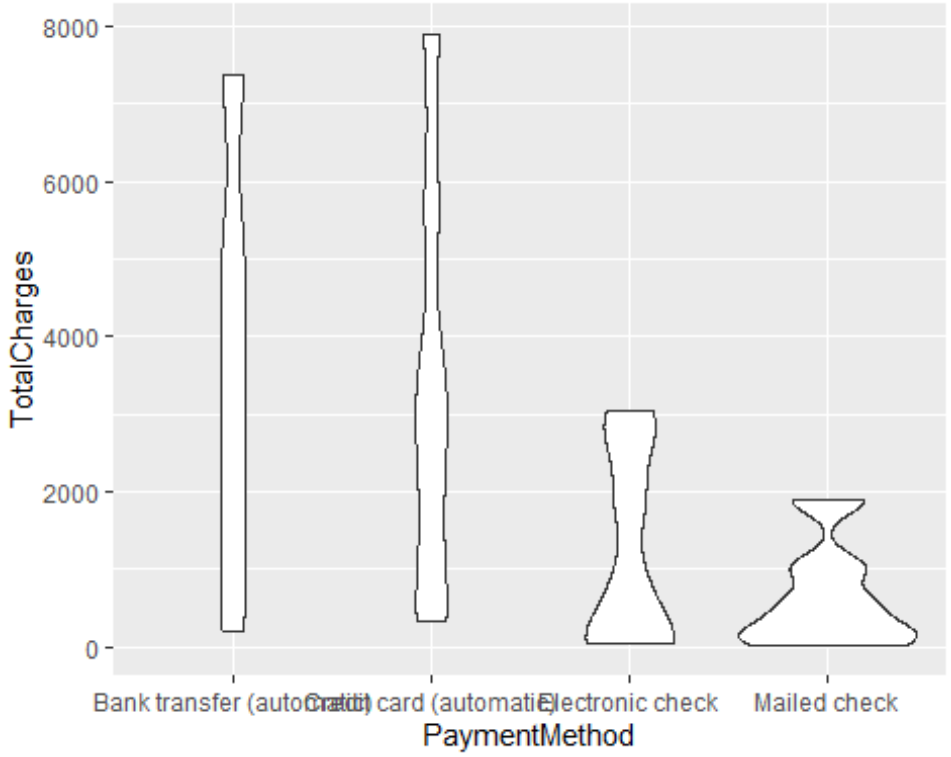



```
telecom+geom_violin()+geom_boxplot(width=.1,fill="black",outlier.colour=NA)+s
tat_summary(fun.y=median,geom="point",fill="white",shape=21,size=1.5)
```

```
## Warning: The `fun.y` argument of `stat_summary()` is deprecated as of ggpl
ot2 3.3.0.
## ℹ Please use the `fun` argument instead.
## This warning is displayed once every 8 hours.
## Call `lifecycle::last_lifecycle_warnings()` to see where this warning was
## generated.
```




```
telecom+geom_violin(adjust=.5)
```




```
str(telecom)
```

```
## List of 9
##  $ data       : tibble [25 × 21] (S3: tbl_df/tbl/data.frame)
##   ..$ customerID      : chr [1:25] "7590-VHVEG" "5575-GNVDE" "3668-QPYBK"
"7795-CFOCW" ...
##   ..$ gender          : chr [1:25] "Female" "Male" "Male" "Male" ...
##   ..$ SeniorCitizen   : num [1:25] 0 0 0 0 0 0 0 0 0 0 ...
##   ..$ Partner         : chr [1:25] "Yes" "No" "No" "No" ...
##   ..$ Dependents      : chr [1:25] "No" "No" "No" "No" ...
##   ..$ tenure          : num [1:25] 1 34 2 45 2 8 22 10 28 62 ...
##   ..$ PhoneService    : chr [1:25] "No" "Yes" "Yes" "No" ...
##   ..$ MultipleLines   : chr [1:25] "No phone service" "No" "No" "No phone
service" ...
##   ..$ InternetService : chr [1:25] "DSL" "DSL" "DSL" "DSL" ...
##   ..$ OnlineSecurity  : chr [1:25] "No" "Yes" "Yes" "Yes" ...
##   ..$ OnlineBackup    : chr [1:25] "Yes" "No" "Yes" "No" ...
##   ..$ DeviceProtection: chr [1:25] "No" "Yes" "No" "Yes" ...
##   ..$ TechSupport     : chr [1:25] "No" "No" "No" "Yes" ...
##   ..$ StreamingTV     : chr [1:25] "No" "No" "No" "No" ...
##   ..$ StreamingMovies : chr [1:25] "No" "No" "No" "No" ...
##   ..$ Contract        : chr [1:25] "Month-to-month" "One year" "Month-to-m
onth" "One year" ...
##   ..$ PaperlessBilling: chr [1:25] "Yes" "No" "Yes" "No" ...
##   ..$ PaymentMethod   : chr [1:25] "Electronic check" "Mailed check" "Mail
ed check" "Bank transfer (automatic)" ...
##   ..$ MonthlyCharges  : num [1:25] 29.9 57 53.9 42.3 70.7 ...
##   ..$ TotalCharges    : num [1:25] 29.9 1889.5 108.2 1840.8 151.7 ...
##   ..$ Churn           : chr [1:25] "No" "No" "Yes" "No" ...
##  $ layers     : list()
##  $ scales     :Classes 'ScalesList', 'ggproto', 'gg' <ggproto object: Clas
s ScalesList, gg>
##     add: function
##     clone: function
##     find: function
##     get_scales: function
##     has_scale: function
##     input: function
##     n: function
##     non_position_scales: function
##     scales: NULL
##     super:  <ggproto object: Class ScalesList, gg>
##  $ mapping    :List of 2
##   ..$ x: language ~PaymentMethod
##   .. ..- attr(*, ".Environment")=<environment: R_GlobalEnv>
##   ..$ y: language ~TotalCharges
##   .. ..- attr(*, ".Environment")=<environment: R_GlobalEnv>
##   ..- attr(*, "class")= chr "uneval"
##  $ theme      : list()
##  $ coordinates:Classes 'CoordCartesian', 'Coord', 'ggproto', 'gg' <ggproto
object: Class CoordCartesian, Coord, gg>
##     aspect: function
```

```
##     backtransform_range: function
##     clip: on
##     default: TRUE
##     distance: function
##     expand: TRUE
##     is_free: function
##     is_linear: function
##     labels: function
##     limits: list
##     modify_scales: function
##     range: function
##     render_axis_h: function
##     render_axis_v: function
##     render_bg: function
##     render_fg: function
##     setup_data: function
##     setup_layout: function
##     setup_panel_guides: function
##     setup_panel_params: function
##     setup_params: function
##     train_panel_guides: function
##     transform: function
##     super:  <ggproto object: Class CoordCartesian, Coord, gg>
##  $ facet      :Classes 'FacetNull', 'Facet', 'ggproto', 'gg' <ggproto obje
ct: Class FacetNull, Facet, gg>
##     compute_layout: function
##     draw_back: function
##     draw_front: function
##     draw_labels: function
##     draw_panels: function
##     finish_data: function
##     init_scales: function
##     map_data: function
##     params: list
##     setup_data: function
##     setup_params: function
##     shrink: TRUE
##     train_scales: function
##     vars: function
##     super:  <ggproto object: Class FacetNull, Facet, gg>
##  $ plot_env   :<environment: R_GlobalEnv>
##  $ labels     :List of 2
##   ..$ x: chr "PaymentMethod"
##   ..$ y: chr "TotalCharges"
##  - attr(*, "class")= chr [1:2] "gg" "ggplot"
```

```
seq(telecom)
```

```
## [1] 1 2 3 4 5 6 7 8 9
```

```
names(telecom)
```

```
## [1] "data"        "layers"      "scales"      "mapping"     "theme"
## [6] "coordinates" "facet"       "plot_env"    "labels"
```

```
class(telecom)
```

```
## [1] "gg"     "ggplot"
```

```
typeof(telecom)
```

```
## [1] "list"
```

```
ls()
```

```
## [1] "myfun"   "telecom"
```

```
unique(telecom$PaymentMethod)
```

```
## NULL
```

```
nrow(telecom)
```

```
## NULL
```

```
ncol(telecom)
```

```
## NULL
```

```
cumsum(telecom$gender)
```

```
## numeric(0)
```

```
cumprod(telecom$tenure)
```

```
## numeric(0)
```

```
cummin(telecom$OnlineSecurity)
```

```
## numeric(0)
```

```
cummax(telecom$TotalCharges)
```

```
## numeric(0)
```

```
length(telecom)
```

```
## [1] 9
```

```
rev(telecom$Partner)
```

```
## NULL
```

```
rep(telecom)
```

```
## $data
## # A tibble: 25 × 21
##    customerID gender SeniorCitizen Partner Dependents tenure PhoneService
##    <chr>      <chr>          <dbl> <chr>   <chr>       <dbl> <chr>
##  1 7590-VHVEG Female             0 Yes     No              1 No
##  2 5575-GNVDE Male               0 No      No             34 Yes
##  3 3668-QPYBK Male               0 No      No              2 Yes
##  4 7795-CFOCW Male               0 No      No             45 No
##  5 9237-HQITU Female             0 No      No              2 Yes
##  6 9305-CDSKC Female             0 No      No              8 Yes
##  7 1452-KIOVK Male               0 No      Yes            22 Yes
##  8 6713-OKOMC Female             0 No      No             10 No
##  9 7892-POOKP Female             0 Yes     No             28 Yes
## 10 6388-TABGU Male               0 No      Yes            62 Yes
## # ℹ 15 more rows
## # ℹ 14 more variables: MultipleLines <chr>, InternetService <chr>,
## #   OnlineSecurity <chr>, OnlineBackup <chr>, DeviceProtection <chr>,
## #   TechSupport <chr>, StreamingTV <chr>, StreamingMovies <chr>,
## #   Contract <chr>, PaperlessBilling <chr>, PaymentMethod <chr>,
## #   MonthlyCharges <dbl>, TotalCharges <dbl>, Churn <chr>
##
## $layers
## list()
##
## $scales
## <ggproto object: Class ScalesList, gg>
##     add: function
##     clone: function
##     find: function
##     get_scales: function
##     has_scale: function
##     input: function
##     n: function
##     non_position_scales: function
##     scales: NULL
##     super:  <ggproto object: Class ScalesList, gg>
##
## $mapping
## Aesthetic mapping:
## * `x` -> `PaymentMethod`
## * `y` -> `TotalCharges`
##
## $theme
## list()
##
## $coordinates
## <ggproto object: Class CoordCartesian, Coord, gg>
##     aspect: function
##     backtransform_range: function
##     clip: on
```

```
##     default: TRUE
##     distance: function
##     expand: TRUE
##     is_free: function
##     is_linear: function
##     labels: function
##     limits: list
##     modify_scales: function
##     range: function
##     render_axis_h: function
##     render_axis_v: function
##     render_bg: function
##     render_fg: function
##     setup_data: function
##     setup_layout: function
##     setup_panel_guides: function
##     setup_panel_params: function
##     setup_params: function
##     train_panel_guides: function
##     transform: function
##     super:  <ggproto object: Class CoordCartesian, Coord, gg>
##
## $facet
## <ggproto object: Class FacetNull, Facet, gg>
##     compute_layout: function
##     draw_back: function
##     draw_front: function
##     draw_labels: function
##     draw_panels: function
##     finish_data: function
##     init_scales: function
##     map_data: function
##     params: list
##     setup_data: function
##     setup_params: function
##     shrink: TRUE
##     train_scales: function
##     vars: function
##     super:  <ggproto object: Class FacetNull, Facet, gg>
##
## $plot_env
## <environment: R_GlobalEnv>
##
## $labels
## $labels$x
## [1] "PaymentMethod"
##
## $labels$y
## [1] "TotalCharges"
```

```
sd(telecom$MonthlyCharges)
```

```
## [1] NA
```

```
median(telecom$MonthlyCharges)
```

```
## NULL
```

```
mean(telecom$MonthlyCharges)
```

```
## Warning in mean.default(telecom$MonthlyCharges): argument is not numeric o
r
## logical: returning NA
```

```
## [1] NA
```

```
sum(telecom$TotalCharges)
```

```
## [1] 0
```

```
telecom$customerID
```

```
## NULL
```

```
formatC(telecom$Dependents)
```

```
## character(0)
```

```
head(telecom)
```

```
## $data
## # A tibble: 25 × 21
##    customerID gender SeniorCitizen Partner Dependents tenure PhoneService
##    <chr>      <chr>          <dbl> <chr>   <chr>       <dbl> <chr>
##  1 7590-VHVEG Female             0 Yes     No              1 No
##  2 5575-GNVDE Male               0 No      No             34 Yes
##  3 3668-QPYBK Male               0 No      No              2 Yes
##  4 7795-CFOCW Male               0 No      No             45 No
##  5 9237-HQITU Female             0 No      No              2 Yes
##  6 9305-CDSKC Female             0 No      No              8 Yes
##  7 1452-KIOVK Male               0 No      Yes            22 Yes
##  8 6713-OKOMC Female             0 No      No             10 No
##  9 7892-POOKP Female             0 Yes     No             28 Yes
## 10 6388-TABGU Male               0 No      Yes            62 Yes
## # ℹ 15 more rows
## # ℹ 14 more variables: MultipleLines <chr>, InternetService <chr>,
## #   OnlineSecurity <chr>, OnlineBackup <chr>, DeviceProtection <chr>,
## #   TechSupport <chr>, StreamingTV <chr>, StreamingMovies <chr>,
## #   Contract <chr>, PaperlessBilling <chr>, PaymentMethod <chr>,
## #   MonthlyCharges <dbl>, TotalCharges <dbl>, Churn <chr>
##
## $layers
## list()
```

```
##
## $scales
## <ggproto object: Class ScalesList, gg>
##     add: function
##     clone: function
##     find: function
##     get_scales: function
##     has_scale: function
##     input: function
##     n: function
##     non_position_scales: function
##     scales: NULL
##     super:  <ggproto object: Class ScalesList, gg>
##
## $mapping
## Aesthetic mapping:
## * `x` -> `PaymentMethod`
## * `y` -> `TotalCharges`
##
## $theme
## list()
##
## $coordinates
## <ggproto object: Class CoordCartesian, Coord, gg>
##     aspect: function
##     backtransform_range: function
##     clip: on
##     default: TRUE
##     distance: function
##     expand: TRUE
##     is_free: function
##     is_linear: function
##     labels: function
##     limits: list
##     modify_scales: function
##     range: function
##     render_axis_h: function
##     render_axis_v: function
##     render_bg: function
##     render_fg: function
##     setup_data: function
##     setup_layout: function
##     setup_panel_guides: function
##     setup_panel_params: function
##     setup_params: function
##     train_panel_guides: function
##     transform: function
##     super:  <ggproto object: Class CoordCartesian, Coord, gg>

tail(telecom)
```

```
## $mapping
## Aesthetic mapping:
## * `x` -> `PaymentMethod`
## * `y` -> `TotalCharges`
##
## $theme
## list()
##
## $coordinates
## <ggproto object: Class CoordCartesian, Coord, gg>
##     aspect: function
##     backtransform_range: function
##     clip: on
##     default: TRUE
##     distance: function
##     expand: TRUE
##     is_free: function
##     is_linear: function
##     labels: function
##     limits: list
##     modify_scales: function
##     range: function
##     render_axis_h: function
##     render_axis_v: function
##     render_bg: function
##     render_fg: function
##     setup_data: function
##     setup_layout: function
##     setup_panel_guides: function
##     setup_panel_params: function
##     setup_params: function
##     train_panel_guides: function
##     transform: function
##     super:  <ggproto object: Class CoordCartesian, Coord, gg>
##
## $facet
## <ggproto object: Class FacetNull, Facet, gg>
##     compute_layout: function
##     draw_back: function
##     draw_front: function
##     draw_labels: function
##     draw_panels: function
##     finish_data: function
##     init_scales: function
##     map_data: function
##     params: list
##     setup_data: function
##     setup_params: function
##     shrink: TRUE
##     train_scales: function
```

```
##     vars: function
##     super:  <ggproto object: Class FacetNull, Facet, gg>
##
## $plot_env
## <environment: R_GlobalEnv>
##
## $labels
## $labels$x
## [1] "PaymentMethod"
##
## $labels$y
## [1] "TotalCharges"
```

```
telecom$InternetService
```

```
## NULL
```

```
is.data.frame(telecom)
```

```
## [1] FALSE
```

```
is.name(telecom)
```

```
## [1] FALSE
```

```
identity(telecom$gender)
```

```
## NULL
```

```
binom.test(29,200,.21)
```

```
##
##  Exact binomial test
##
## data:  29 and 200
## number of successes = 29, number of trials = 200, p-value = 0.02374
## alternative hypothesis: true probability of success is not equal to 0.21
## 95 percent confidence interval:
##  0.09930862 0.20156150
## sample estimates:
## probability of success
##                  0.145
```

```
pbinom(2,5,.5)
```

```
## [1] 0.5
```

```
dbinom(0,5,.5)
```

```
## [1] 0.03125
```

```
prop.test(29,200,.21)
```

```
##
##  1-sample proportions test with continuity correction
##
## data:  29 out of 200, null probability 0.21
## X-squared = 4.7092, df = 1, p-value = 0.03
## alternative hypothesis: true p is not equal to 0.21
## 95 percent confidence interval:
##  0.1007793 0.2032735
## sample estimates:
##     p
## 0.145

diff(telecom$TotalCharges)

## NULL

pmax(telecom$TotalCharges)

## NULL

pmin(telecom$TotalCharges)

## NULL

summary(telecom$customerID)

## Length  Class   Mode
##      0   NULL   NULL

summary(telecom$gender)

## Length  Class   Mode
##      0   NULL   NULL

summary(telecom$SeniorCitizen)

## Length  Class   Mode
##      0   NULL   NULL

summary(telecom$Partner)

## Length  Class   Mode
##      0   NULL   NULL

summary(telecom$Dependents)

## Length  Class   Mode
##      0   NULL   NULL

summary(telecom$MultipleLines)

## Length  Class   Mode
##      0   NULL   NULL
```

```
dim(telecom)

## NULL

summary(telecom$Contract)

## Length  Class   Mode
##      0   NULL   NULL
```

R Markdown

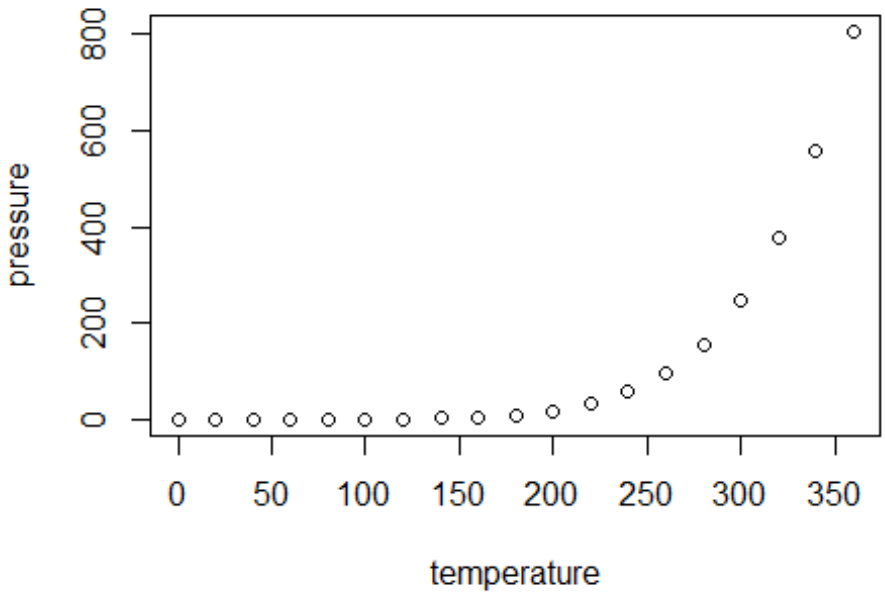
This is an R Markdown document. Markdown is a simple formatting syntax for authoring HTML, PDF, and MS Word documents. For more details on using R Markdown see http://rmarkdown.rstudio.com.

When you click the **Knit** button a document will be generated that includes both content as well as the output of any embedded R code chunks within the document. You can embed an R code chunk like this:

```
summary(cars)

##      speed           dist
##  Min.   : 4.0   Min.   :  2.00
##  1st Qu.:12.0   1st Qu.: 26.00
##  Median :15.0   Median : 36.00
##  Mean   :15.4   Mean   : 42.98
##  3rd Qu.:19.0   3rd Qu.: 56.00
##  Max.   :25.0   Max.   :120.00
```

Including Plots

You can also embed plots, for example:



Note that the `echo = FALSE` parameter was added to the code chunk to prevent printing of the R code that generated the plot.