Plot_Proportion_Studies_0510

Lan Tao

2023-05-12

read data

```
num_greedy_05_m30_pr2_11<-read_excel("~/Desktop/Matching Market/Simulation/Simulation_0510/Simulation_R
num_patient_05_m30_pr2_11<-read_excel("~/Desktop/Matching Market/Simulation/Simulation_0510/Simulation_

num_greedy_05_m30_pr2_12<-read_excel("~/Desktop/Matching Market/Simulation/Simulation_0510/Simulation_R
num_patient_05_m30_pr2_12<-read_excel("~/Desktop/Matching Market/Simulation/Simulation_0510/Simulation_

num_greedy_05_m30_pr2_13<-read_excel("~/Desktop/Matching Market/Simulation/Simulation_0510/Simulation_R
num_patient_05_m30_pr2_13<-read_excel("~/Desktop/Matching Market/Simulation/Simulation_0510/Simulation_

num_greedy_05_m30_pr2_14<-read_excel("~/Desktop/Matching Market/Simulation/Simulation_0510/Simulation_R
num_patient_05_m30_pr2_14<-read_excel("~/Desktop/Matching Market/Simulation/Simulation_0510/Simulation_


#-------------------------------------------------------------------------------

num_greedy_05_m50_pr2_11<-read_excel("~/Desktop/Matching Market/Simulation/Simulation_0510/Simulation_R
num_patient_05_m50_pr2_11<-read_excel("~/Desktop/Matching Market/Simulation/Simulation_0510/Simulation_

num_greedy_05_m50_pr2_12<-read_excel("~/Desktop/Matching Market/Simulation/Simulation_0510/Simulation_R
num_patient_05_m50_pr2_12<-read_excel("~/Desktop/Matching Market/Simulation/Simulation_0510/Simulation_

num_greedy_05_m50_pr2_13<-read_excel("~/Desktop/Matching Market/Simulation/Simulation_0510/Simulation_R
num_patient_05_m50_pr2_13<-read_excel("~/Desktop/Matching Market/Simulation/Simulation_0510/Simulation_

num_greedy_05_m50_pr2_14<-read_excel("~/Desktop/Matching Market/Simulation/Simulation_0510/Simulation_R
num_patient_05_m50_pr2_14<-read_excel("~/Desktop/Matching Market/Simulation/Simulation_0510/Simulation_


#-------------------------------------------------------------------------------

num_greedy_05_m70_pr2_11<-read_excel("~/Desktop/Matching Market/Simulation/Simulation_0510/Simulation_R
num_patient_05_m70_pr2_11<-read_excel("~/Desktop/Matching Market/Simulation/Simulation_0510/Simulation_

num_greedy_05_m70_pr2_12<-read_excel("~/Desktop/Matching Market/Simulation/Simulation_0510/Simulation_R
num_patient_05_m70_pr2_12<-read_excel("~/Desktop/Matching Market/Simulation/Simulation_0510/Simulation_

num_greedy_05_m70_pr2_13<-read_excel("~/Desktop/Matching Market/Simulation/Simulation_0510/Simulation_R
num_patient_05_m70_pr2_13<-read_excel("~/Desktop/Matching Market/Simulation/Simulation_0510/Simulation_

num_greedy_05_m70_pr2_14<-read_excel("~/Desktop/Matching Market/Simulation/Simulation_0510/Simulation_R
```

```
num_patient_05_m70_pr2_14<-read_excel("~/Desktop/Matching Market/Simulation/Simulation_0510/Simulation_

#-------------------------------------------------------------------------------

num_greedy_05_m100_pr2_11<-read_excel("~/Desktop/Matching Market/Simulation/Simulation_0510/Simulation_
num_patient_05_m100_pr2_11<-read_excel("~/Desktop/Matching Market/Simulation/Simulation_0510/Simulation

num_greedy_05_m100_pr2_12<-read_excel("~/Desktop/Matching Market/Simulation/Simulation_0510/Simulation_
num_patient_05_m100_pr2_12<-read_excel("~/Desktop/Matching Market/Simulation/Simulation_0510/Simulation

num_greedy_05_m100_pr2_13<-read_excel("~/Desktop/Matching Market/Simulation/Simulation_0510/Simulation_
num_patient_05_m100_pr2_13<-read_excel("~/Desktop/Matching Market/Simulation/Simulation_0510/Simulation

num_greedy_05_m100_pr2_14<-read_excel("~/Desktop/Matching Market/Simulation/Simulation_0510/Simulation_
num_patient_05_m100_pr2_14<-read_excel("~/Desktop/Matching Market/Simulation/Simulation_0510/Simulation
```

Part 1 - plot the loss

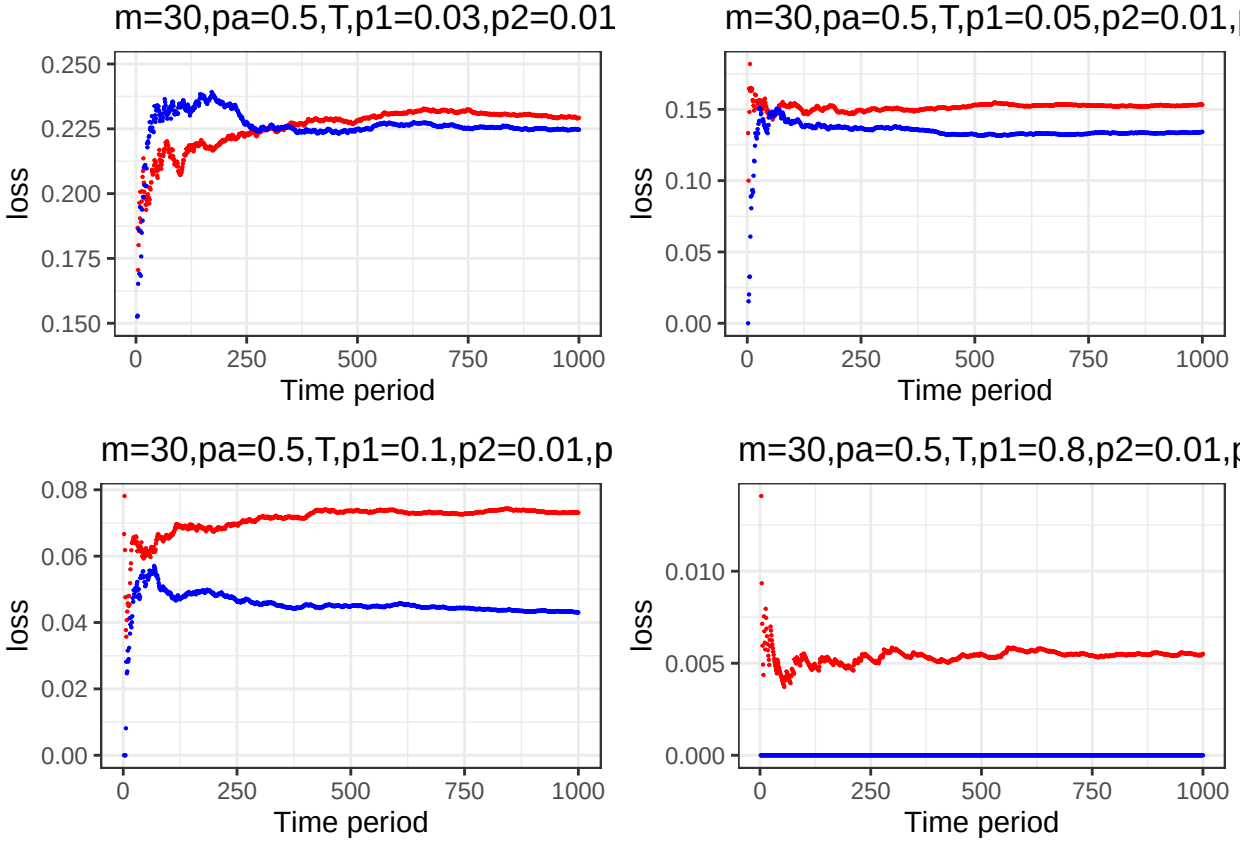
Market size m = 30

```
#-----------------------------------------------
T=1000

p1<-ggplot(data = NULL, aes(x = c(1:T), y = loss)) +
  geom_point(data=num_greedy_05_m30_pr2_11,col="red",size=0.1) +
  geom_point(data=num_patient_05_m30_pr2_11,col="blue",size=0.1) +
  ylim(0.15,0.25)+
  xlab("Time period")+
  labs(title = "m=30,pa=0.5,T,p1=0.03,p2=0.01,pr=2") +
  theme_bw()

#-----------------------------------------------
p2<-ggplot(data = NULL, aes(x = c(1:T), y = loss)) +
  geom_point(data=num_greedy_05_m30_pr2_12,col="red",size=0.1) +
  geom_point(data=num_patient_05_m30_pr2_12,col="blue",size=0.1) +
  xlab("Time period")+
  #ylim(-0.01,0.01)+
  labs(title = "m=30,pa=0.5,T,p1=0.05,p2=0.01,pr=2") +
  theme_bw()

#-----------------------------------------------
p3<-ggplot(data = NULL, aes(x = c(1:T), y = loss)) +
  geom_point(data=num_greedy_05_m30_pr2_13,col="red",size=0.1) +
  geom_point(data=num_patient_05_m30_pr2_13,col="blue",size=0.1) +
  #ylim(-0.01,0.01)+
  xlab("Time period")+
  labs(title = "m=30,pa=0.5,T,p1=0.1,p2=0.01,pr=2") +
  theme_bw()

#-----------------------------------------------
p4<-ggplot(data = NULL, aes(x = c(1:T), y = loss)) +
  geom_point(data=num_greedy_05_m30_pr2_14,col="red",size=0.1) +
```

```
  geom_point(data=num_patient_05_m30_pr2_14,col="blue",size=0.1) +
  #ylim(-0.01,0.01)+
  xlab("Time period")+
  labs(title = "m=30,pa=0.5,T,p1=0.8,p2=0.01,pr=2") +
  theme_bw()

grid.arrange(p1,p2,p3,p4,nrow=2,ncol=2 )
```

```
## Warning: Removed 3 rows containing missing values (`geom_point()`).
## Removed 3 rows containing missing values (`geom_point()`).
```

```
## Warning: Removed 1 rows containing missing values (`geom_point()`).
## Removed 1 rows containing missing values (`geom_point()`).
## Removed 1 rows containing missing values (`geom_point()`).
## Removed 1 rows containing missing values (`geom_point()`).
## Removed 1 rows containing missing values (`geom_point()`).
## Removed 1 rows containing missing values (`geom_point()`).
```

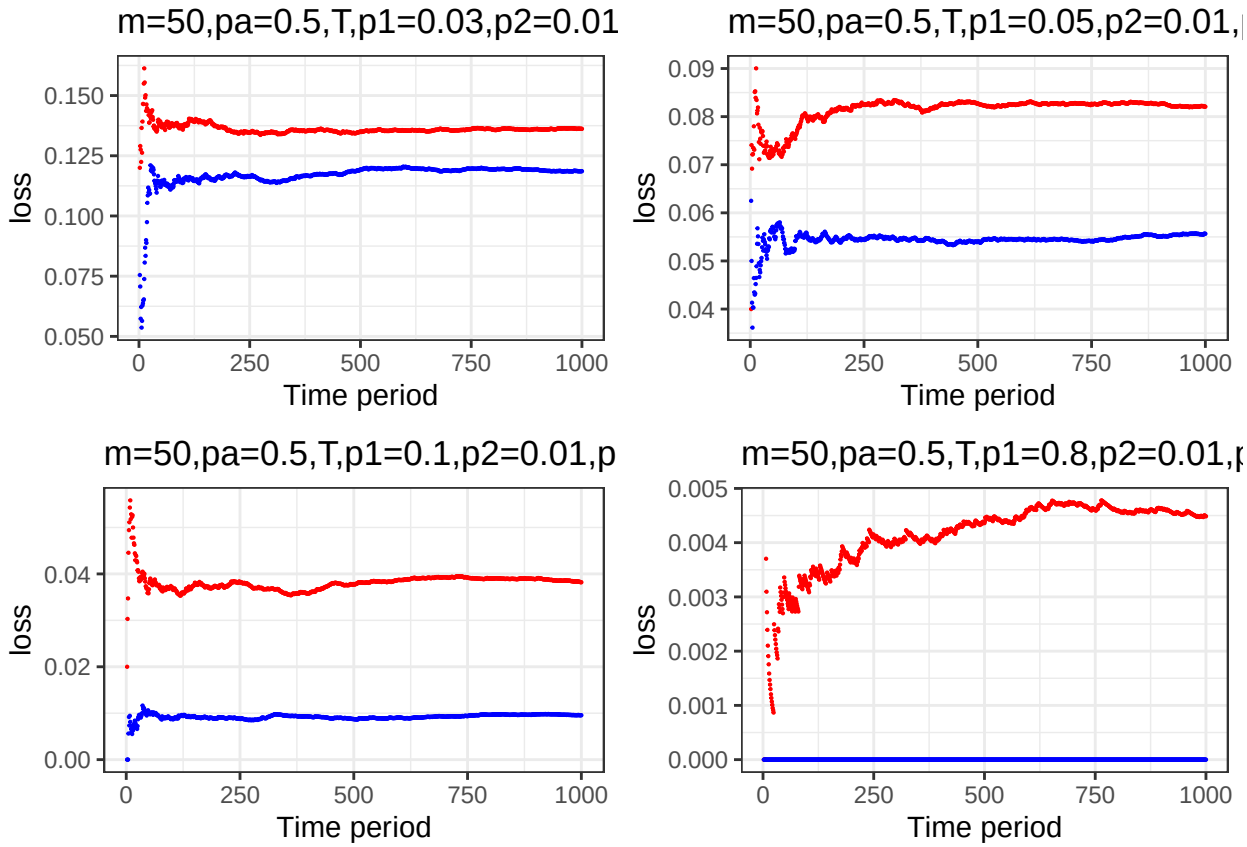


Market size m = 50

```
#-----------------------------------------------
T=1000

p1<-ggplot(data = NULL, aes(x = c(1:T), y = loss)) +
  geom_point(data=num_greedy_05_m50_pr2_11,col="red",size=0.1) +
  geom_point(data=num_patient_05_m50_pr2_11,col="blue",size=0.1) +
```

```
  #ylim(0.15,0.25)+
  xlab("Time period")+
  labs(title = "m=50,pa=0.5,T,p1=0.03,p2=0.01,pr=2") +
  theme_bw()

#-----------------------------------------------
p2<-ggplot(data = NULL, aes(x = c(1:T), y = loss)) +
  geom_point(data=num_greedy_05_m50_pr2_12,col="red",size=0.1) +
  geom_point(data=num_patient_05_m50_pr2_12,col="blue",size=0.1) +
  xlab("Time period")+
  #ylim(-0.01,0.01)+
  labs(title = "m=50,pa=0.5,T,p1=0.05,p2=0.01,pr=2") +
  theme_bw()

#-----------------------------------------------
p3<-ggplot(data = NULL, aes(x = c(1:T), y = loss)) +
  geom_point(data=num_greedy_05_m50_pr2_13,col="red",size=0.1) +
  geom_point(data=num_patient_05_m50_pr2_13,col="blue",size=0.1) +
  #ylim(-0.01,0.01)+
  xlab("Time period")+
  labs(title = "m=50,pa=0.5,T,p1=0.1,p2=0.01,pr=2") +
  theme_bw()

#-----------------------------------------------
p4<-ggplot(data = NULL, aes(x = c(1:T), y = loss)) +
  geom_point(data=num_greedy_05_m50_pr2_14,col="red",size=0.1) +
  geom_point(data=num_patient_05_m50_pr2_14,col="blue",size=0.1) +
  #ylim(-0.01,0.01)+
  xlab("Time period")+
  labs(title = "m=50,pa=0.5,T,p1=0.8,p2=0.01,pr=2") +
  theme_bw()

grid.arrange(p1,p2,p3,p4,nrow=2,ncol=2 )
```

```
## Warning: Removed 1 rows containing missing values (`geom_point()`).
## Removed 1 rows containing missing values (`geom_point()`).
## Removed 1 rows containing missing values (`geom_point()`).
## Removed 1 rows containing missing values (`geom_point()`).
## Removed 1 rows containing missing values (`geom_point()`).
## Removed 1 rows containing missing values (`geom_point()`).
## Removed 1 rows containing missing values (`geom_point()`).
## Removed 1 rows containing missing values (`geom_point()`).
```

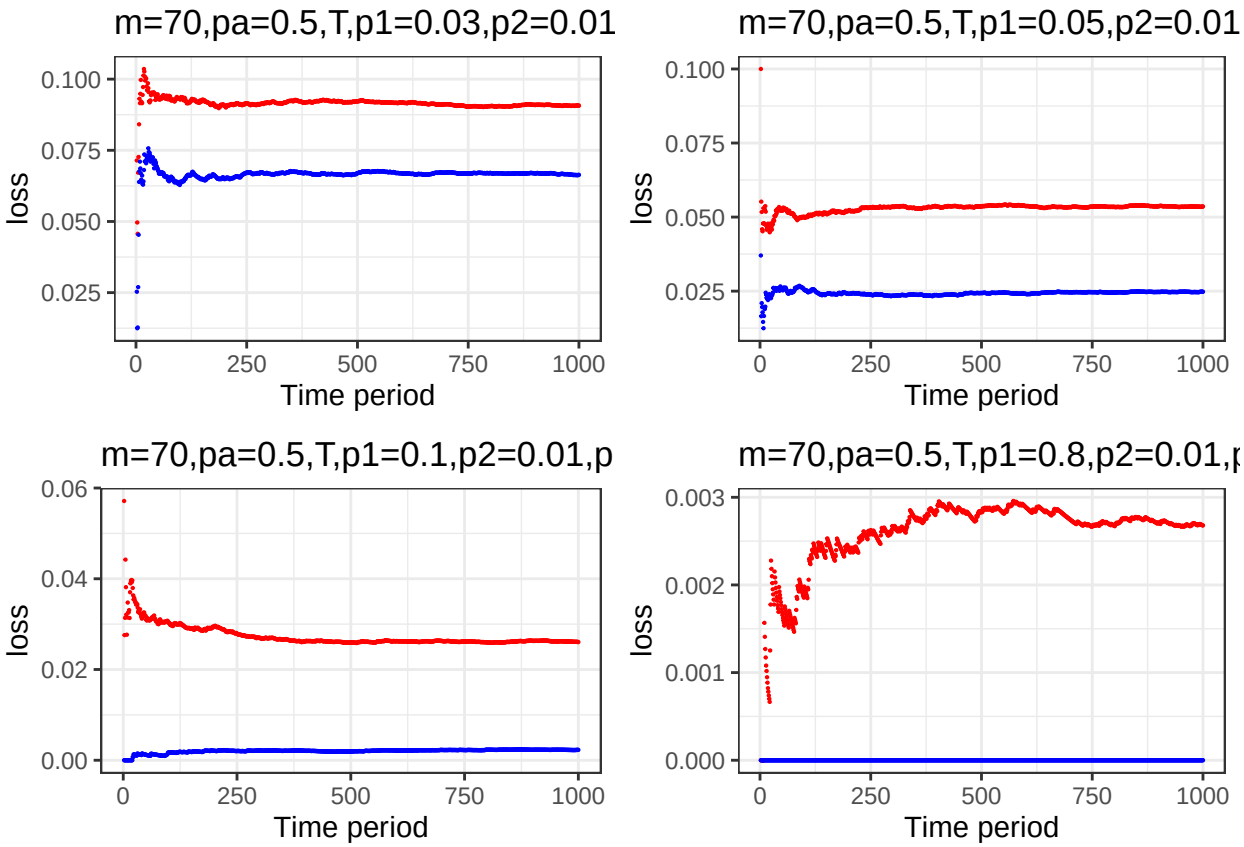


Market size m = 70

```
#-----------------------------------------------
T=1000

p1<-ggplot(data = NULL, aes(x = c(1:T), y = loss)) +
  geom_point(data=num_greedy_05_m70_pr2_11,col="red",size=0.1) +
  geom_point(data=num_patient_05_m70_pr2_11,col="blue",size=0.1) +
  #ylim(0.15,0.25)+
  xlab("Time period")+
  labs(title = "m=70,pa=0.5,T,p1=0.03,p2=0.01,pr=2") +
  theme_bw()

#-----------------------------------------------
p2<-ggplot(data = NULL, aes(x = c(1:T), y = loss)) +
  geom_point(data=num_greedy_05_m70_pr2_12,col="red",size=0.1) +
  geom_point(data=num_patient_05_m70_pr2_12,col="blue",size=0.1) +
  xlab("Time period")+
  #ylim(-0.01,0.01)+
  labs(title = "m=70,pa=0.5,T,p1=0.05,p2=0.01,pr=2") +
  theme_bw()

#-----------------------------------------------
p3<-ggplot(data = NULL, aes(x = c(1:T), y = loss)) +
  geom_point(data=num_greedy_05_m70_pr2_13,col="red",size=0.1) +
```

```
  geom_point(data=num_patient_05_m70_pr2_13,col="blue",size=0.1) +
  #ylim(-0.01,0.01)+
  xlab("Time period")+
  labs(title = "m=70,pa=0.5,T,p1=0.1,p2=0.01,pr=2") +
  theme_bw()

#-------------------------------------------------
p4<-ggplot(data = NULL, aes(x = c(1:T), y = loss)) +
  geom_point(data=num_greedy_05_m70_pr2_14,col="red",size=0.1) +
  geom_point(data=num_patient_05_m70_pr2_14,col="blue",size=0.1) +
  #ylim(-0.01,0.01)+
  xlab("Time period")+
  labs(title = "m=70,pa=0.5,T,p1=0.8,p2=0.01,pr=2") +
  theme_bw()

grid.arrange(p1,p2,p3,p4,nrow=2,ncol=2 )
```

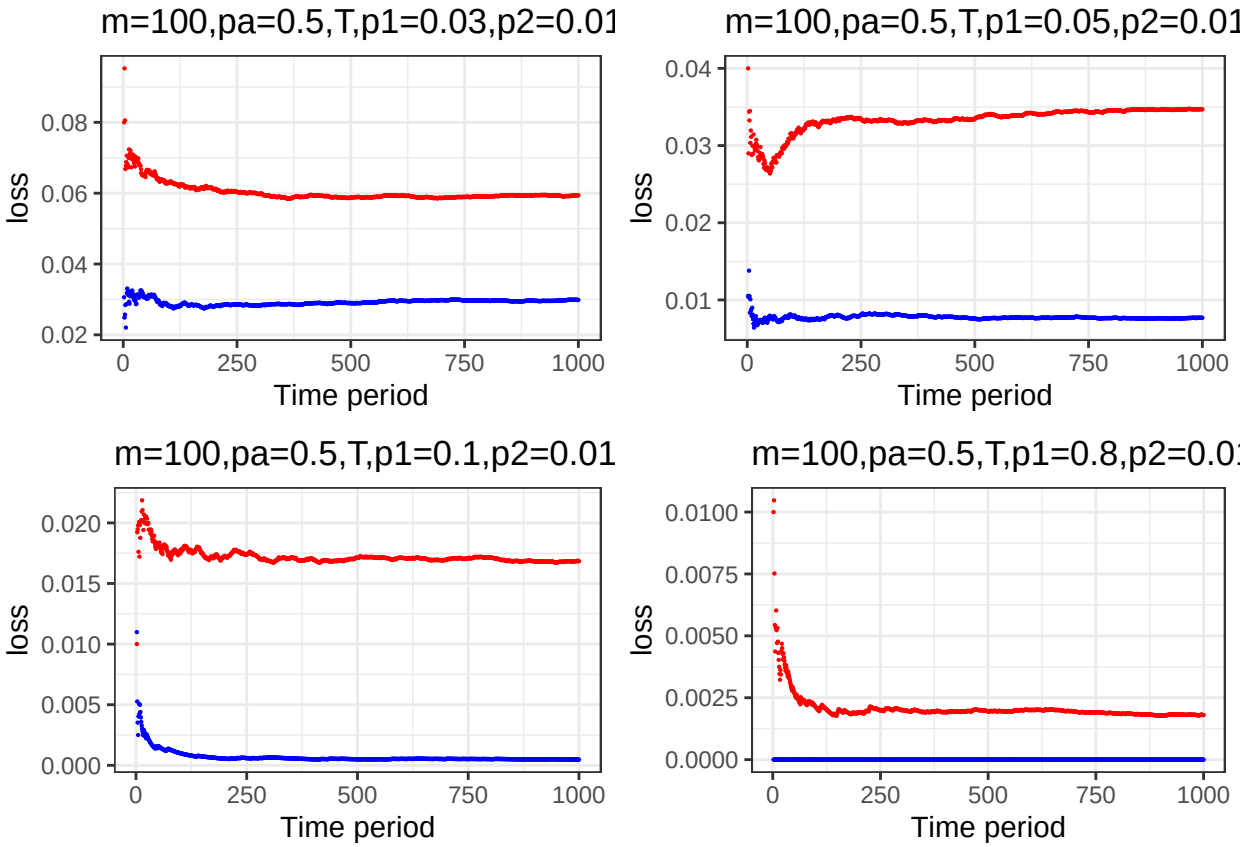
```
## Warning: Removed 1 rows containing missing values (`geom_point()`).
## Removed 1 rows containing missing values (`geom_point()`).
## Removed 1 rows containing missing values (`geom_point()`).
## Removed 1 rows containing missing values (`geom_point()`).
## Removed 1 rows containing missing values (`geom_point()`).
## Removed 1 rows containing missing values (`geom_point()`).
## Removed 1 rows containing missing values (`geom_point()`).
## Removed 1 rows containing missing values (`geom_point()`).
```



Market size m = 100

```
#-----------------------------------------------
T=1000

p1<-ggplot(data = NULL, aes(x = c(1:T), y = loss)) +
  geom_point(data=num_greedy_05_m100_pr2_11,col="red",size=0.1) +
  geom_point(data=num_patient_05_m100_pr2_11,col="blue",size=0.1) +
  #ylim(0.15,0.25)+
  xlab("Time period")+
  labs(title = "m=100,pa=0.5,T,p1=0.03,p2=0.01,pr=2") +
  theme_bw()

#-----------------------------------------------
p2<-ggplot(data = NULL, aes(x = c(1:T), y = loss)) +
  geom_point(data=num_greedy_05_m100_pr2_12,col="red",size=0.1) +
  geom_point(data=num_patient_05_m100_pr2_12,col="blue",size=0.1) +
  xlab("Time period")+
  #ylim(-0.01,0.01)+
  labs(title = "m=100,pa=0.5,T,p1=0.05,p2=0.01,pr=2") +
  theme_bw()

#-----------------------------------------------
p3<-ggplot(data = NULL, aes(x = c(1:T), y = loss)) +
  geom_point(data=num_greedy_05_m100_pr2_13,col="red",size=0.1) +
  geom_point(data=num_patient_05_m100_pr2_13,col="blue",size=0.1) +
  #ylim(-0.01,0.01)+
  xlab("Time period")+
  labs(title = "m=100,pa=0.5,T,p1=0.1,p2=0.01,pr=2") +
  theme_bw()

#-----------------------------------------------
p4<-ggplot(data = NULL, aes(x = c(1:T), y = loss)) +
  geom_point(data=num_greedy_05_m100_pr2_14,col="red",size=0.1) +
  geom_point(data=num_patient_05_m100_pr2_14,col="blue",size=0.1) +
  #ylim(-0.01,0.01)+
  xlab("Time period")+
  labs(title = "m=100,pa=0.5,T,p1=0.8,p2=0.01,pr=2") +
  theme_bw()

grid.arrange(p1,p2,p3,p4,nrow=2,ncol=2 )
```

```
## Warning: Removed 1 rows containing missing values (`geom_point()`).
## Removed 1 rows containing missing values (`geom_point()`).
## Removed 1 rows containing missing values (`geom_point()`).
## Removed 1 rows containing missing values (`geom_point()`).
## Removed 1 rows containing missing values (`geom_point()`).
## Removed 1 rows containing missing values (`geom_point()`).
## Removed 1 rows containing missing values (`geom_point()`).
```



#---

Part 2 - plot the distribution of proportion

2.1 Greedy algorithm plot

```
p1 <- ggplot(num_greedy_05_m30_pr2_11[800:1000,], aes(x=prop)) +
 geom_histogram(aes(y=..density..), colour="black", fill="white")+
 geom_density(alpha=.2, fill="#FF6666")+
 labs(title = "Greedy - m=30,pa=0.5,T,p1=0.03,p2=0.01,pr=2")+
 theme_bw()

p2 <- ggplot(data = NULL, aes(x = c(1:T), y = prop)) +
  geom_point(data=num_greedy_05_m30_pr2_11,size=0.1) +
  ylim(0,4)+
  xlab("Time period")+
  labs(title = "Greedy - m=30,pa=0.5,T,p1=0.03,p2=0.01,pr=2") +
  theme_bw()


#------------------------------------------------------------------------------

p3 <- ggplot(num_greedy_05_m30_pr2_12[800:1000,], aes(x=prop)) +
 geom_histogram(aes(y=..density..), colour="black", fill="white")+
 geom_density(alpha=.2, fill="#FF6666")+
```

```
 labs(title = "Greedy - m=30,pa=0.5,T,p1=0.05,p2=0.01,pr=2")+
 theme_bw()

p4 <- ggplot(data = NULL, aes(x = c(1:T), y = prop)) +
  geom_point(data=num_greedy_05_m30_pr2_12,size=0.1) +
  ylim(0,5)+
  xlab("Time period")+
  labs(title = "Greedy - m=30,pa=0.5,T,p1=0.05,p2=0.01,pr=2") +
  theme_bw()


#-------------------------------------------------------------------------------

p5 <- ggplot(num_greedy_05_m30_pr2_13[800:1000,], aes(x=prop)) +
 geom_histogram(aes(y=..density..), colour="black", fill="white")+
 geom_density(alpha=.2, fill="#FF6666")+
 labs(title = "Greedy - m=30,pa=0.5,T,p1=0.1,p2=0.01,pr=2")+
 theme_bw()

p6 <- ggplot(data = NULL, aes(x = c(1:T), y = as.double(prop))) +
  geom_point(data=num_greedy_05_m30_pr2_13,size=0.1) +
  xlab("Time period")+
  ylab("prop")+
  ylim(0,6)+
  labs(title = "Greedy - m=30,pa=0.5,T,p1=0.1,p2=0.01,pr=2") +
  theme_bw()


#-------------------------------------------------------------------------------

p7 <- ggplot(num_greedy_05_m30_pr2_14[800:1000,], aes(x=prop)) +
 geom_histogram(aes(y=..density..), colour="black", fill="white")+
 geom_density(alpha=.2, fill="#FF6666")+
 labs(title = "Greedy - m=30,pa=0.5,T,p1=0.8,p2=0.01,pr=2")+
 theme_bw()


p8 <- ggplot(data = NULL, aes(x = c(1:T), y = prop)) +
  geom_point(data=num_greedy_05_m30_pr2_14,size=0.1) +
  xlab("Time period")+
  labs(title = "Greedy - m=30,pa=0.5,T,p1=0.8,p2=0.01,pr=2") +
  theme_bw()


grid.arrange(p1,p2,p3,p4,p6,p8,nrow=3,ncol=2 )
```

2.1.1 market size m = 30

```
## Warning: The dot-dot notation (`..density..`) was deprecated in ggplot2 3.4.0.
## i Please use `after_stat(density)` instead.
```

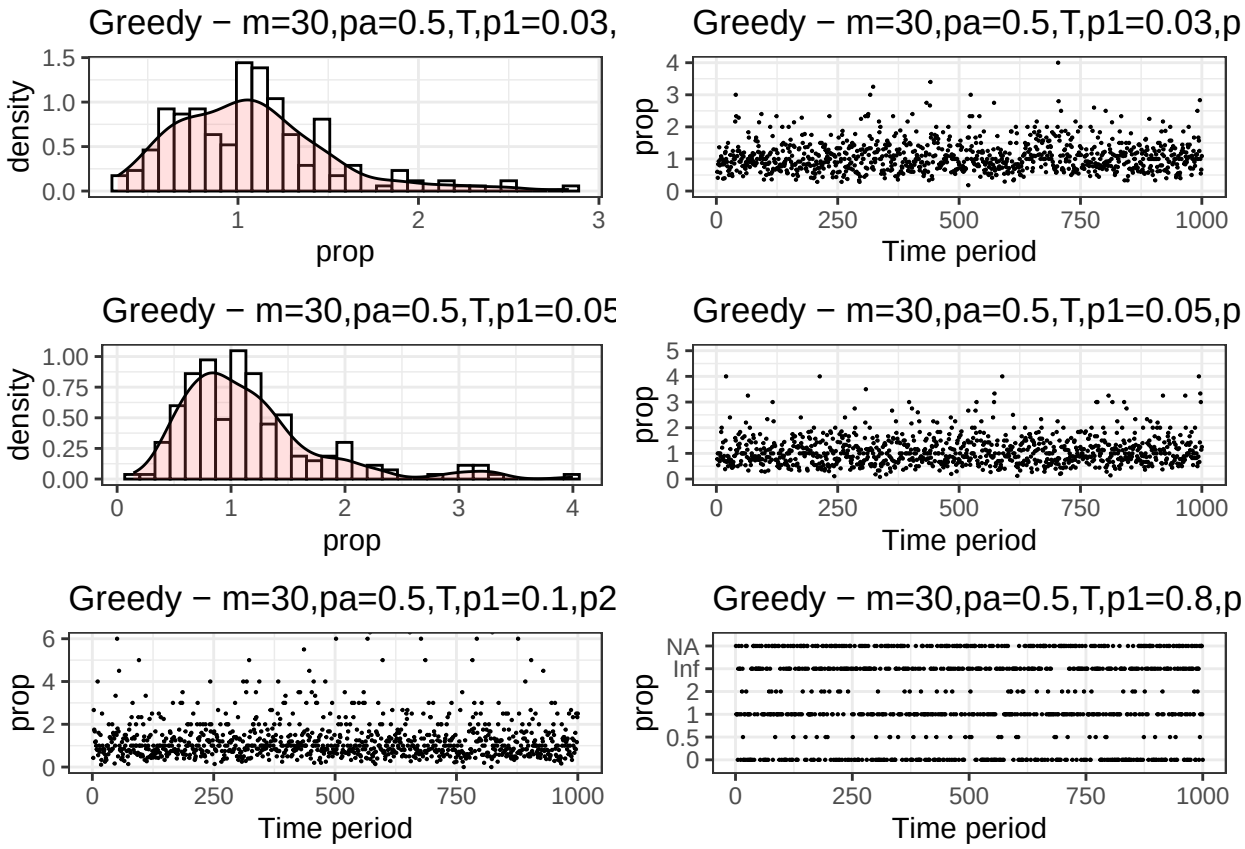
```
## `stat_bin()` using `bins = 30`. Pick better value with `binwidth`.
```

```
## Warning: Removed 2 rows containing missing values (`geom_point()`).
```

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

```
## Warning: Removed 5 rows containing missing values (`geom_point()`).
```

```
## Warning: Removed 4 rows containing missing values (`geom_point()`).
```

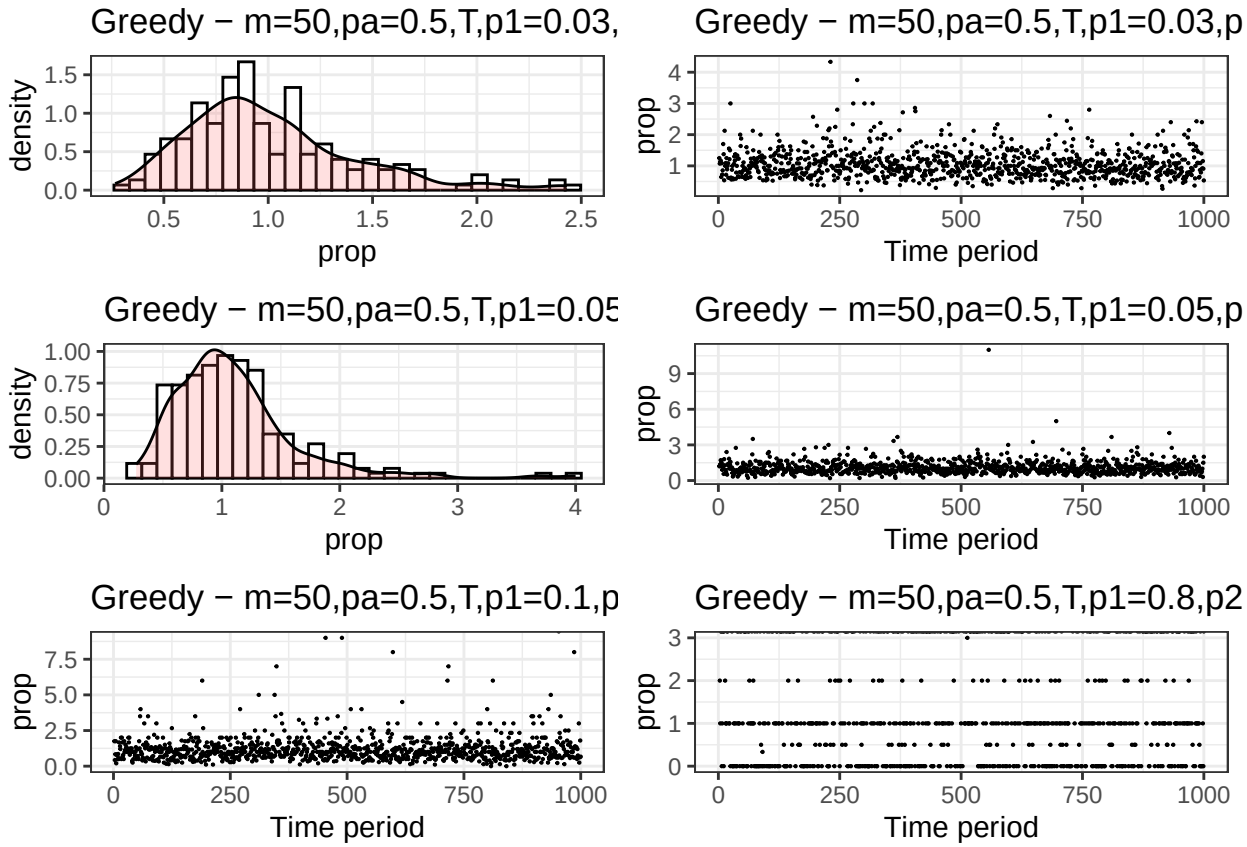



```
p1 <- ggplot(num_greedy_05_m50_pr2_11[800:1000,], aes(x=prop)) +
 geom_histogram(aes(y=..density..), colour="black", fill="white")+
 geom_density(alpha=.2, fill="#FF6666")+
 labs(title = "Greedy - m=50,pa=0.5,T,p1=0.03,p2=0.01,pr=2")+
 theme_bw()

p2 <- ggplot(data = NULL, aes(x = c(1:T), y = prop)) +
  geom_point(data=num_greedy_05_m50_pr2_11,size=0.1) +
  #ylim(0,4)+
  xlab("Time period")+
  labs(title = "Greedy - m=50,pa=0.5,T,p1=0.03,p2=0.01,pr=2") +
  theme_bw()


#-------------------------------------------------------------------------------

p3 <- ggplot(num_greedy_05_m50_pr2_12[800:1000,], aes(x=prop)) +
 geom_histogram(aes(y=..density..), colour="black", fill="white")+
 geom_density(alpha=.2, fill="#FF6666")+
 labs(title = "Greedy - m=50,pa=0.5,T,p1=0.05,p2=0.01,pr=2")+
 theme_bw()
```

```
p4 <- ggplot(data = NULL, aes(x = c(1:T), y = prop)) +
  geom_point(data=num_greedy_05_m50_pr2_12,size=0.1) +
  #ylim(0,5)+
  xlab("Time period")+
  labs(title = "Greedy - m=50,pa=0.5,T,p1=0.05,p2=0.01,pr=2") +
  theme_bw()


#-------------------------------------------------------------------------------

p5 <- ggplot(num_greedy_05_m50_pr2_13[800:1000,], aes(x=prop)) +
 geom_histogram(aes(y=..density..), colour="black", fill="white")+
 geom_density(alpha=.2, fill="#FF6666")+
 labs(title = "Greedy - m=50,pa=0.5,T,p1=0.1,p2=0.01,pr=2")+
 theme_bw()

p6 <- ggplot(data = NULL, aes(x = c(1:T), y = as.double(prop))) +
  geom_point(data=num_greedy_05_m50_pr2_13,size=0.1) +
  xlab("Time period")+
  ylab("prop")+
  labs(title = "Greedy - m=50,pa=0.5,T,p1=0.1,p2=0.01,pr=2") +
  theme_bw()


#-------------------------------------------------------------------------------

p7 <- ggplot(num_greedy_05_m50_pr2_14[800:1000,], aes(x=prop)) +
 geom_histogram(aes(y=..density..), colour="black", fill="white")+
 geom_density(alpha=.2, fill="#FF6666")+
 labs(title = "Greedy - m=50,pa=0.5,T,p1=0.8,p2=0.01,pr=2")+
 theme_bw()

p8 <- ggplot(data = NULL, aes(x = c(1:T), y = as.double(prop))) +
  geom_point(data=num_greedy_05_m50_pr2_14,size=0.1) +
  xlab("Time period")+
  ylab("prop")+
  labs(title = "Greedy - m=50,pa=0.5,T,p1=0.8,p2=0.01,pr=2") +
  theme_bw()


grid.arrange(p1,p2,p3,p4,p6,p8,nrow=3,ncol=2 )
```

2.1.2 market size m = 50

```
## `stat_bin()` using `bins = 30`. Pick better value with `binwidth`.
## Warning: Removed 1 rows containing missing values (`geom_point()`).
## `stat_bin()` using `bins = 30`. Pick better value with `binwidth`.
## Warning: Removed 1 rows containing missing values (`geom_point()`).
## Removed 1 rows containing missing values (`geom_point()`).
## Warning: Removed 213 rows containing missing values (`geom_point()`).
```




```
p1 <- ggplot(num_greedy_05_m70_pr2_11[800:1000,], aes(x=prop)) +
 geom_histogram(aes(y=..density..), colour="black", fill="white")+
 geom_density(alpha=.2, fill="#FF6666")+
 labs(title = "Greedy - m=70,pa=0.5,T,p1=0.03,p2=0.01,pr=2")+
 theme_bw()

p2 <- ggplot(data = NULL, aes(x = c(1:T), y = prop)) +
  geom_point(data=num_greedy_05_m70_pr2_11,size=0.1) +
  #ylim(0,4)+
  xlab("Time period")+
  labs(title = "Greedy - m=70,pa=0.5,T,p1=0.03,p2=0.01,pr=2") +
  theme_bw()


#-------------------------------------------------------------------------------

p3 <- ggplot(num_greedy_05_m70_pr2_12[800:1000,], aes(x=prop)) +
 geom_histogram(aes(y=..density..), colour="black", fill="white")+
 geom_density(alpha=.2, fill="#FF6666")+
 labs(title = "Greedy - m=70,pa=0.5,T,p1=0.05,p2=0.01,pr=2")+
 theme_bw()

p4 <- ggplot(data = NULL, aes(x = c(1:T), y = prop)) +
  geom_point(data=num_greedy_05_m70_pr2_12,size=0.1) +
  #ylim(0,5)+
```

```
  xlab("Time period")+
  labs(title = "Greedy - m=70,pa=0.5,T,p1=0.05,p2=0.01,pr=2") +
  theme_bw()

#------------------------------------------------------------------------------

p5 <- ggplot(num_greedy_05_m70_pr2_13[800:1000,], aes(x=prop)) +
 geom_histogram(aes(y=..density..), colour="black", fill="white")+
 geom_density(alpha=.2, fill="#FF6666")+
 labs(title = "Greedy - m=70,pa=0.5,T,p1=0.1,p2=0.01,pr=2")+
 theme_bw()

p6 <- ggplot(data = NULL, aes(x = c(1:T), y = as.double(prop))) +
  geom_point(data=num_greedy_05_m70_pr2_13,size=0.1) +
  ylab("prop")+
  xlab("Time period")+
  labs(title = "Greedy - m=70,pa=0.5,T,p1=0.1,p2=0.01,pr=2") +
  theme_bw()

#------------------------------------------------------------------------------

p7 <- ggplot(num_greedy_05_m70_pr2_14[800:1000,], aes(x=prop)) +
 geom_histogram(aes(y=..density..), colour="black", fill="white")+
 geom_density(alpha=.2, fill="#FF6666")+
 labs(title = "Greedy - m=70,pa=0.5,T,p1=0.8,p2=0.01,pr=2")+
 theme_bw()

p8 <- ggplot(data = NULL, aes(x = c(1:T), y = as.double(prop))) +
  geom_point(data=num_greedy_05_m70_pr2_14,size=0.1) +
  xlab("Time period")+
  ylab("prop")+
  labs(title = "Greedy - m=70,pa=0.5,T,p1=0.8,p2=0.01,pr=2") +
  theme_bw()


grid.arrange(p1,p2,p3,p4,p6,p8,nrow=3,ncol=2 )
```

2.1.3 market size m = 70

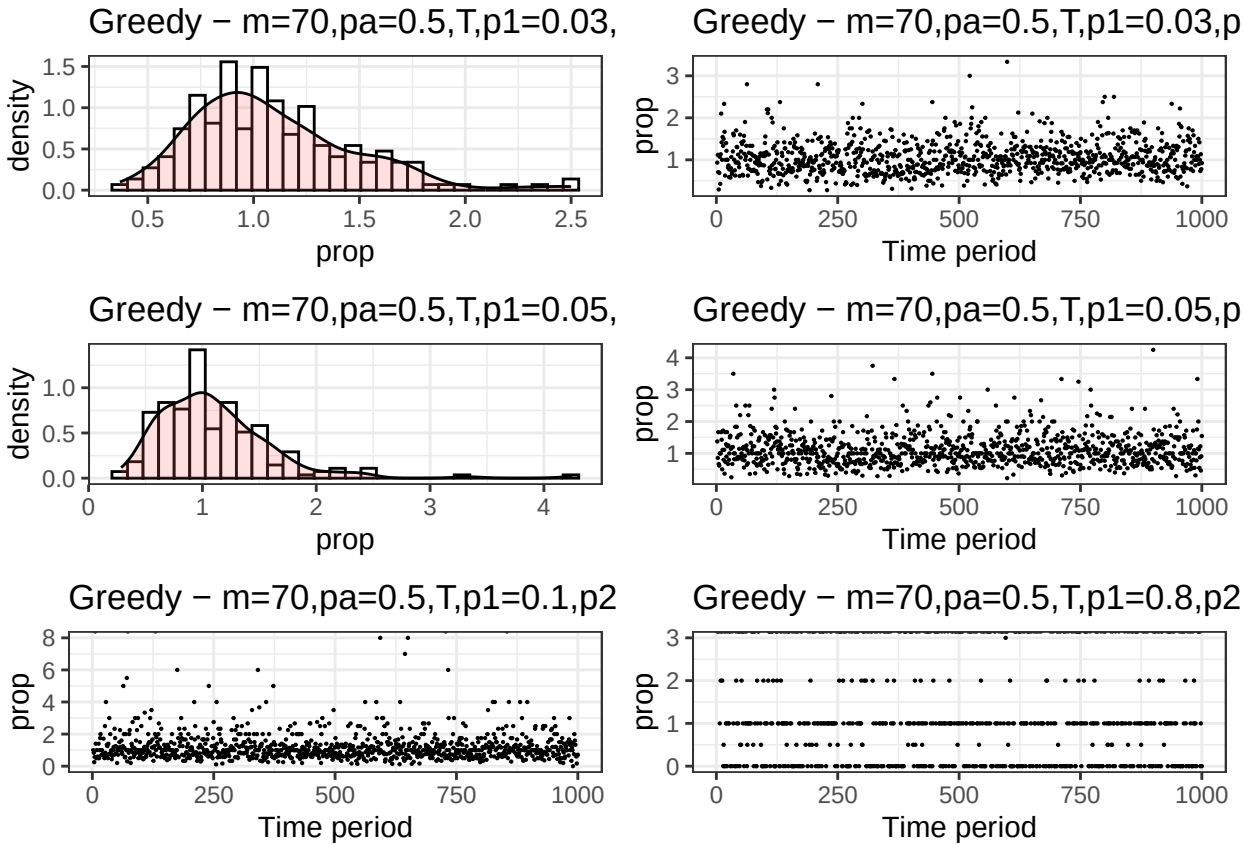
```
## `stat_bin()` using `bins = 30`. Pick better value with `binwidth`.
```

```
## Warning: Removed 1 rows containing missing values (`geom_point()`).
```

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

```
## Warning: Removed 1 rows containing missing values (`geom_point()`).
## Removed 1 rows containing missing values (`geom_point()`).
```

```
## Warning: Removed 221 rows containing missing values (`geom_point()`).
```




```
p1 <- ggplot(num_greedy_05_m100_pr2_11[800:1000,], aes(x=prop)) +
 geom_histogram(aes(y=..density..), colour="black", fill="white")+
 geom_density(alpha=.2, fill="#FF6666")+
 labs(title = "Greedy - m=100,pa=0.5,T,p1=0.03,p2=0.01,pr=2")+
 theme_bw()

p2 <- ggplot(data = NULL, aes(x = c(1:T), y = prop)) +
  geom_point(data=num_greedy_05_m100_pr2_11,size=0.1) +
  #ylim(0,4)+
  xlab("Time period")+
  labs(title = "Greedy - m=100,pa=0.5,T,p1=0.03,p2=0.01,pr=2") +
  theme_bw()

#-------------------------------------------------------------------------------

p3 <- ggplot(num_greedy_05_m100_pr2_12[800:1000,], aes(x=prop)) +
 geom_histogram(aes(y=..density..), colour="black", fill="white")+
 geom_density(alpha=.2, fill="#FF6666")+
 labs(title = "Greedy - m=100,pa=0.5,T,p1=0.05,p2=0.01,pr=2")+
 theme_bw()

p4 <- ggplot(data = NULL, aes(x = c(1:T), y = as.double(prop))) +
  geom_point(data=num_greedy_05_m100_pr2_12,size=0.1) +
  #ylim(0,5)+
  ylab("prop")+
```

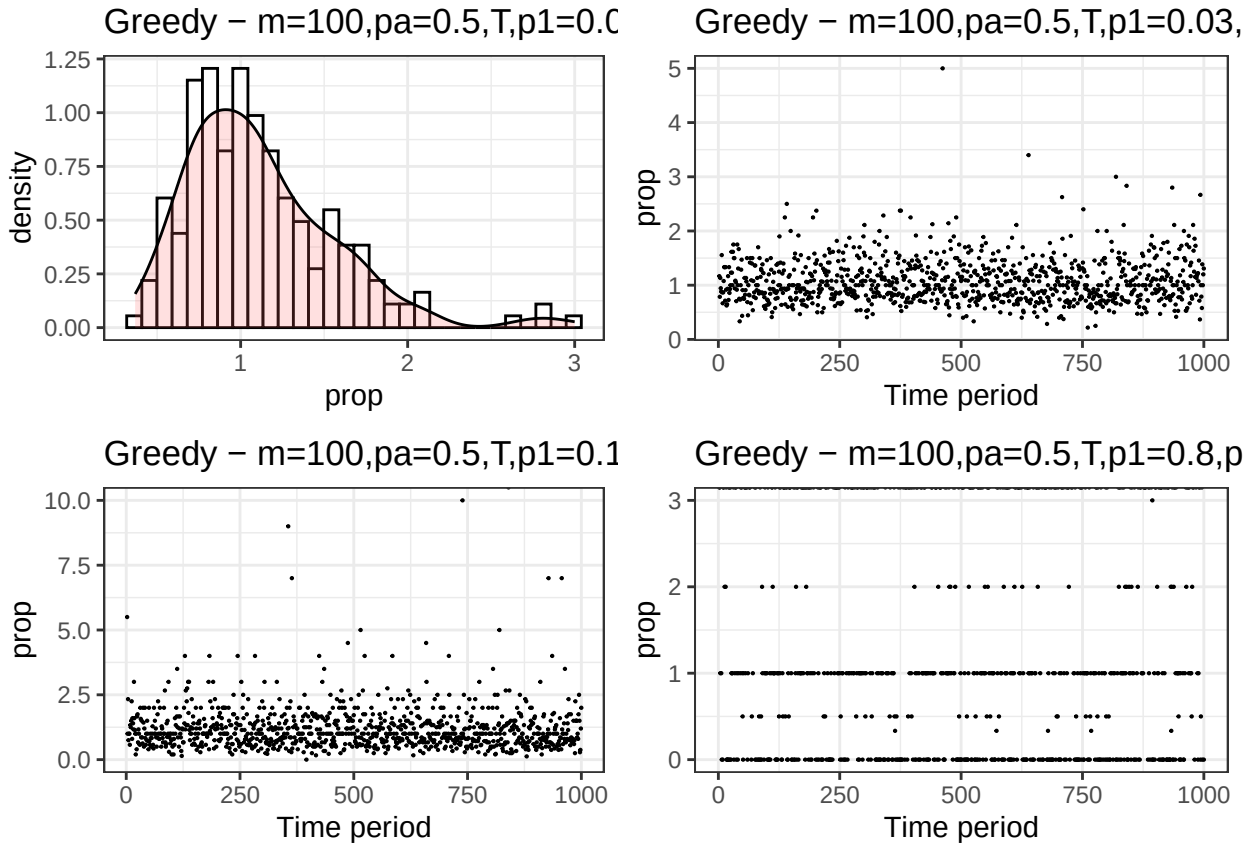
```
  xlab("Time period")+
  labs(title = "Greedy - m=100,pa=0.5,T,p1=0.05,p2=0.01,pr=2") +
  theme_bw()

#-------------------------------------------------------------------------------

p5 <- ggplot(num_greedy_05_m100_pr2_13[800:1000,], aes(x=prop)) +
 geom_histogram(aes(y=..density..), colour="black", fill="white")+
 geom_density(alpha=.2, fill="#FF6666")+
 labs(title = "Greedy - m=100,pa=0.5,T,p1=0.1,p2=0.01,pr=2")+
 theme_bw()

p6 <- ggplot(data = NULL, aes(x = c(1:T), y = as.double(prop))) +
  geom_point(data=num_greedy_05_m100_pr2_13,size=0.1) +
  xlab("Time period")+
  ylab("prop")+
  labs(title = "Greedy - m=100,pa=0.5,T,p1=0.1,p2=0.01,pr=2") +
  theme_bw()

#-------------------------------------------------------------------------------

p7 <- ggplot(num_greedy_05_m100_pr2_14[800:1000,], aes(x=prop)) +
 geom_histogram(aes(y=..density..), colour="black", fill="white")+
 geom_density(alpha=.2, fill="#FF6666")+
 labs(title = "Greedy - m=100,pa=0.5,T,p1=0.8,p2=0.01,pr=2")+
 theme_bw()

p8 <- ggplot(data = NULL, aes(x = c(1:T), y = as.double(prop))) +
  geom_point(data=num_greedy_05_m100_pr2_14,size=0.1) +
  xlab("Time period")+
  ylab("prop")+
  labs(title = "Greedy - m=100,pa=0.5,T,p1=0.8,p2=0.01,pr=2") +
  theme_bw()


grid.arrange(p1,p2,p6,p8,nrow=2,ncol=2 )
```

2.1.4 market size m = 100

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

```
## Warning: Removed 1 rows containing missing values (`geom_point()`).
## Removed 1 rows containing missing values (`geom_point()`).
```

```
## Warning: Removed 218 rows containing missing values (`geom_point()`).
```



2.2 Patient algorithm plot

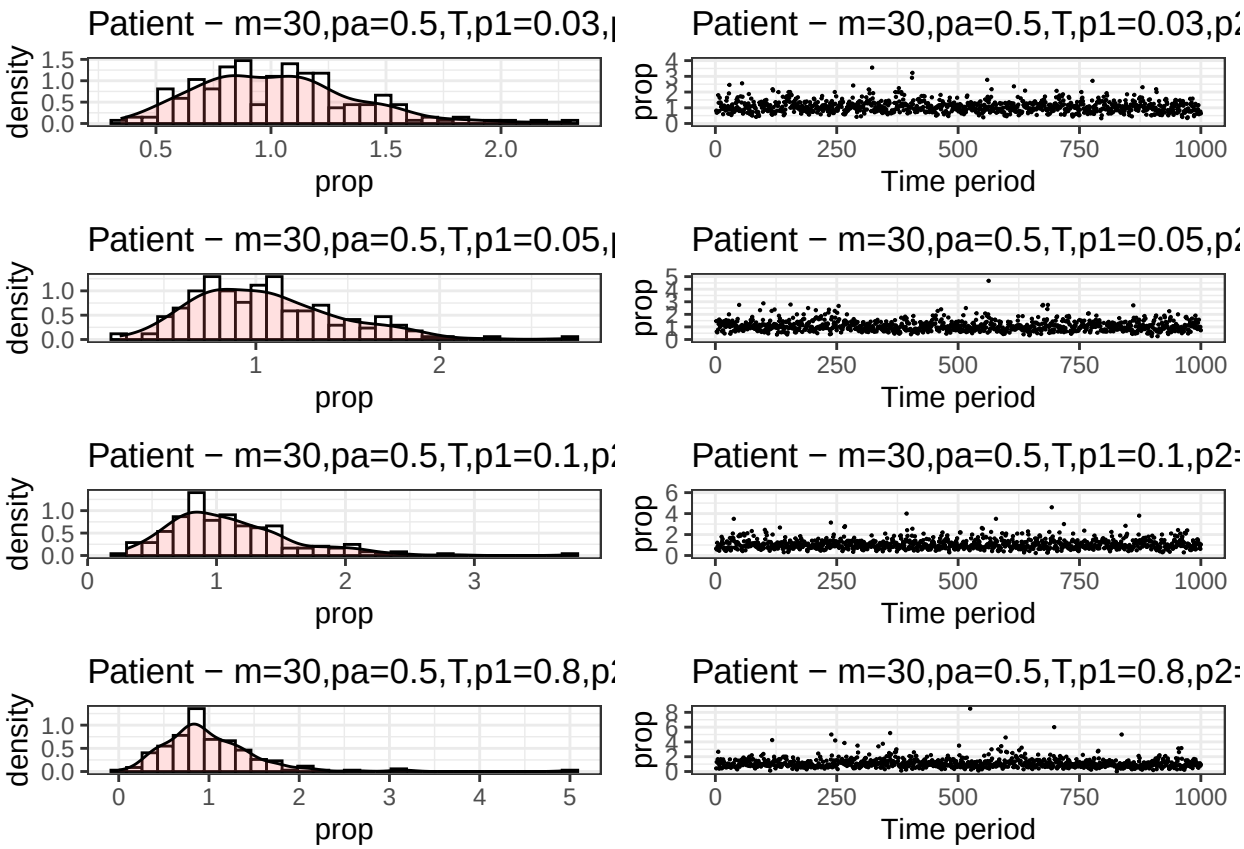
```
p1 <- ggplot(num_patient_05_m30_pr2_11[800:1000,], aes(x=prop)) +
 geom_histogram(aes(y=..density..), colour="black", fill="white")+
 geom_density(alpha=.2, fill="#FF6666")+
 labs(title = "Patient - m=30,pa=0.5,T,p1=0.03,p2=0.01,pr=2")+
 theme_bw()

p2 <- ggplot(data = NULL, aes(x = c(1:T), y = prop)) +
  geom_point(data=num_patient_05_m30_pr2_11,size=0.1) +
  ylim(0,4)+
  xlab("Time period")+
  labs(title = "Patient - m=30,pa=0.5,T,p1=0.03,p2=0.01,pr=2") +
  theme_bw()


#------------------------------------------------------------------------------

p3 <- ggplot(num_patient_05_m30_pr2_12[800:1000,], aes(x=prop)) +
 geom_histogram(aes(y=..density..), colour="black", fill="white")+
 geom_density(alpha=.2, fill="#FF6666")+
 labs(title = "Patient - m=30,pa=0.5,T,p1=0.05,p2=0.01,pr=2")+
 theme_bw()

p4 <- ggplot(data = NULL, aes(x = c(1:T), y = prop)) +
```

```
  geom_point(data=num_patient_05_m30_pr2_12,size=0.1) +
  ylim(0,5)+
  xlab("Time period")+
  labs(title = "Patient - m=30,pa=0.5,T,p1=0.05,p2=0.01,pr=2") +
  theme_bw()


#-------------------------------------------------------------------------------

p5 <- ggplot(num_patient_05_m30_pr2_13[800:1000,], aes(x=prop)) +
 geom_histogram(aes(y=..density..), colour="black", fill="white")+
 geom_density(alpha=.2, fill="#FF6666")+
 labs(title = "Patient - m=30,pa=0.5,T,p1=0.1,p2=0.01,pr=2")+
 theme_bw()

p6 <- ggplot(data = NULL, aes(x = c(1:T), y = as.double(prop))) +
  geom_point(data=num_patient_05_m30_pr2_13,size=0.1) +
  xlab("Time period")+
  ylab("prop")+
  ylim(0,6)+
  labs(title = "Patient - m=30,pa=0.5,T,p1=0.1,p2=0.01,pr=2") +
  theme_bw()


#-------------------------------------------------------------------------------

p7 <- ggplot(num_patient_05_m30_pr2_14[800:1000,], aes(x=prop)) +
 geom_histogram(aes(y=..density..), colour="black", fill="white")+
 geom_density(alpha=.2, fill="#FF6666")+
 labs(title = "Patient - m=30,pa=0.5,T,p1=0.8,p2=0.01,pr=2")+
 theme_bw()


p8 <- ggplot(data = NULL, aes(x = c(1:T), y = prop)) +
  geom_point(data=num_patient_05_m30_pr2_14,size=0.1) +
  xlab("Time period")+
  labs(title = "Patient - m=30,pa=0.5,T,p1=0.8,p2=0.01,pr=2") +
  theme_bw()


grid.arrange(p1,p2,p3,p4,p5,p6,p7,p8,nrow=4,ncol=2 )
```

2.2.1 market size m = 30

```
## `stat_bin()` using `bins = 30`. Pick better value with `binwidth`.
## Warning: Removed 1 rows containing missing values (`geom_point()`).
## `stat_bin()` using `bins = 30`. Pick better value with `binwidth`.
## Warning: Removed 1 rows containing missing values (`geom_point()`).
## `stat_bin()` using `bins = 30`. Pick better value with `binwidth`.
## Warning: Removed 1 rows containing missing values (`geom_point()`).
## `stat_bin()` using `bins = 30`. Pick better value with `binwidth`.
```

```
## Warning: Removed 1 rows containing missing values (`geom_point()`).
```

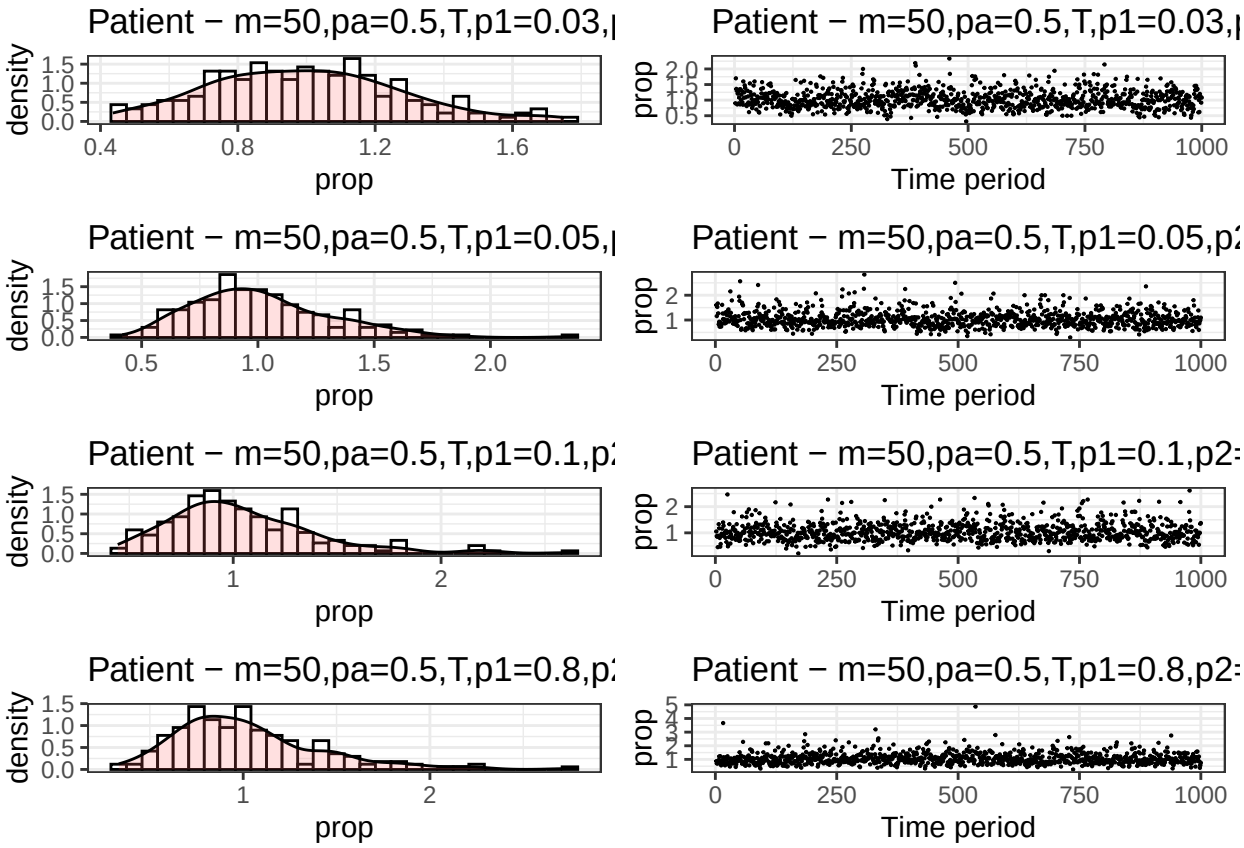



```
p1 <- ggplot(num_patient_05_m50_pr2_11[800:1000,], aes(x=prop)) +
 geom_histogram(aes(y=..density..), colour="black", fill="white")+
 geom_density(alpha=.2, fill="#FF6666")+
 labs(title = "Patient - m=50,pa=0.5,T,p1=0.03,p2=0.01,pr=2")+
 theme_bw()

p2 <- ggplot(data = NULL, aes(x = c(1:T), y = prop)) +
  geom_point(data=num_patient_05_m50_pr2_11,size=0.1) +
  #ylim(0,4)+
  xlab("Time period")+
  labs(title = "Patient - m=50,pa=0.5,T,p1=0.03,p2=0.01,pr=2") +
  theme_bw()


#-------------------------------------------------------------------------------

p3 <- ggplot(num_patient_05_m50_pr2_12[800:1000,], aes(x=prop)) +
 geom_histogram(aes(y=..density..), colour="black", fill="white")+
 geom_density(alpha=.2, fill="#FF6666")+
 labs(title = "Patient - m=50,pa=0.5,T,p1=0.05,p2=0.01,pr=2")+
 theme_bw()

p4 <- ggplot(data = NULL, aes(x = c(1:T), y = prop)) +
```

```
  geom_point(data=num_patient_05_m50_pr2_12,size=0.1) +
  #ylim(0,5)+
  xlab("Time period")+
  labs(title = "Patient - m=50,pa=0.5,T,p1=0.05,p2=0.01,pr=2") +
  theme_bw()


#-------------------------------------------------------------------------------

p5 <- ggplot(num_patient_05_m50_pr2_13[800:1000,], aes(x=prop)) +
 geom_histogram(aes(y=..density..), colour="black", fill="white")+
 geom_density(alpha=.2, fill="#FF6666")+
 labs(title = "Patient - m=50,pa=0.5,T,p1=0.1,p2=0.01,pr=2")+
 theme_bw()

p6 <- ggplot(data = NULL, aes(x = c(1:T), y = as.double(prop))) +
  geom_point(data=num_patient_05_m50_pr2_13,size=0.1) +
  xlab("Time period")+
  ylab("prop")+
  labs(title = "Patient - m=50,pa=0.5,T,p1=0.1,p2=0.01,pr=2") +
  theme_bw()


#-------------------------------------------------------------------------------

p7 <- ggplot(num_patient_05_m50_pr2_14[800:1000,], aes(x=prop)) +
 geom_histogram(aes(y=..density..), colour="black", fill="white")+
 geom_density(alpha=.2, fill="#FF6666")+
 labs(title = "Patient - m=50,pa=0.5,T,p1=0.8,p2=0.01,pr=2")+
 theme_bw()

p8 <- ggplot(data = NULL, aes(x = c(1:T), y = as.double(prop))) +
  geom_point(data=num_patient_05_m50_pr2_14,size=0.1) +
  xlab("Time period")+
  ylab("prop")+
  labs(title = "Patient - m=50,pa=0.5,T,p1=0.8,p2=0.01,pr=2") +
  theme_bw()


grid.arrange(p1,p2,p3,p4,p5,p6,p7,p8,nrow=4,ncol=2 )
```

2.2.2 market size m = 50

```
## `stat_bin()` using `bins = 30`. Pick better value with `binwidth`.
## Warning: Removed 1 rows containing missing values (`geom_point()`).
## `stat_bin()` using `bins = 30`. Pick better value with `binwidth`.
## Warning: Removed 1 rows containing missing values (`geom_point()`).
## `stat_bin()` using `bins = 30`. Pick better value with `binwidth`.
## Warning: Removed 1 rows containing missing values (`geom_point()`).
## `stat_bin()` using `bins = 30`. Pick better value with `binwidth`.
## Warning: Removed 1 rows containing missing values (`geom_point()`).
```

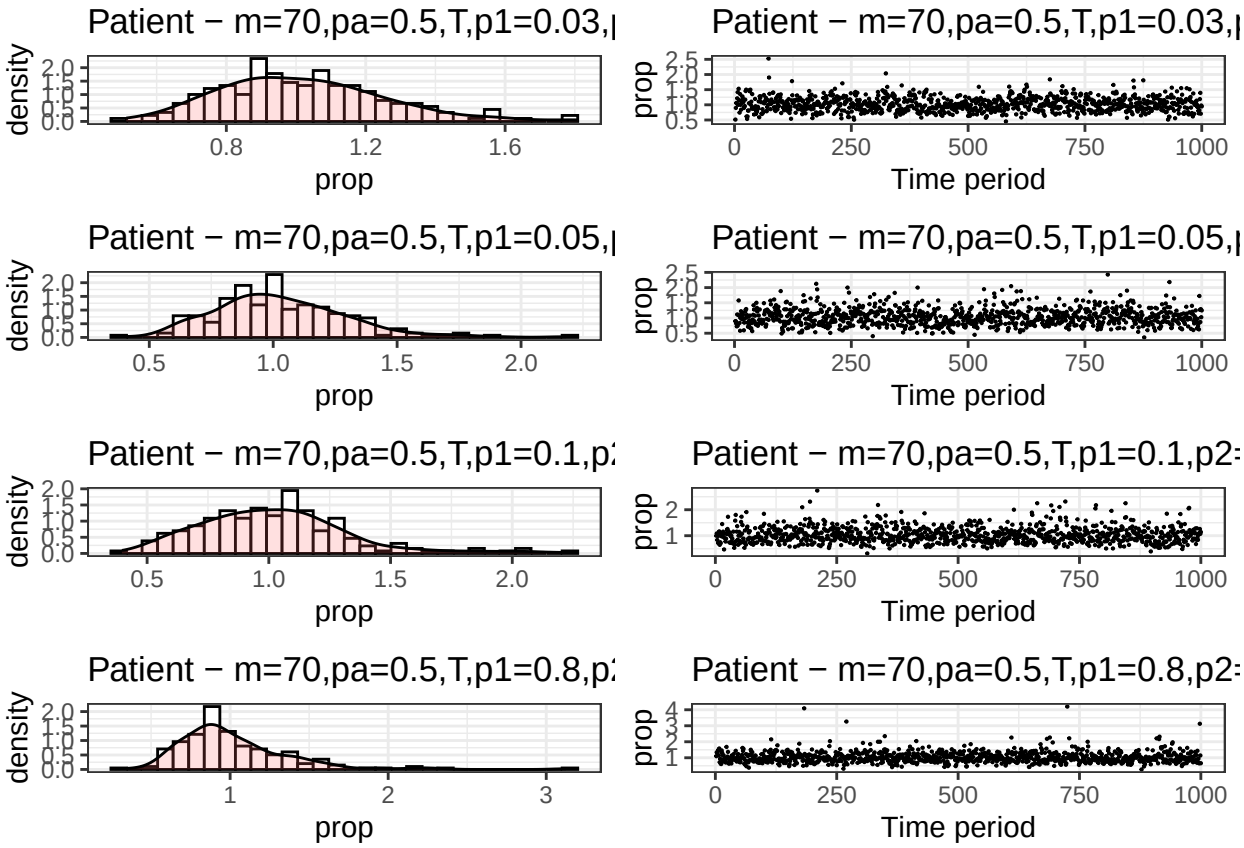



```
p1 <- ggplot(num_patient_05_m70_pr2_11[800:1000,], aes(x=prop)) +
 geom_histogram(aes(y=..density..), colour="black", fill="white")+
 geom_density(alpha=.2, fill="#FF6666")+
 labs(title = "Patient - m=70,pa=0.5,T,p1=0.03,p2=0.01,pr=2")+
 theme_bw()

p2 <- ggplot(data = NULL, aes(x = c(1:T), y = prop)) +
  geom_point(data=num_patient_05_m70_pr2_11,size=0.1) +
  #ylim(0,4)+
  xlab("Time period")+
  labs(title = "Patient - m=70,pa=0.5,T,p1=0.03,p2=0.01,pr=2") +
  theme_bw()


#-------------------------------------------------------------------------------

p3 <- ggplot(num_patient_05_m70_pr2_12[800:1000,], aes(x=prop)) +
 geom_histogram(aes(y=..density..), colour="black", fill="white")+
 geom_density(alpha=.2, fill="#FF6666")+
 labs(title = "Patient - m=70,pa=0.5,T,p1=0.05,p2=0.01,pr=2")+
 theme_bw()

p4 <- ggplot(data = NULL, aes(x = c(1:T), y = prop)) +
  geom_point(data=num_patient_05_m70_pr2_12,size=0.1) +
  #ylim(0,5)+
```

```
  xlab("Time period")+
  labs(title = "Patient - m=70,pa=0.5,T,p1=0.05,p2=0.01,pr=2") +
  theme_bw()

#-------------------------------------------------------------------------------

p5 <- ggplot(num_patient_05_m70_pr2_13[800:1000,], aes(x=prop)) +
 geom_histogram(aes(y=..density..), colour="black", fill="white")+
 geom_density(alpha=.2, fill="#FF6666")+
 labs(title = "Patient - m=70,pa=0.5,T,p1=0.1,p2=0.01,pr=2")+
 theme_bw()

p6 <- ggplot(data = NULL, aes(x = c(1:T), y = as.double(prop))) +
  geom_point(data=num_patient_05_m70_pr2_13,size=0.1) +
  ylab("prop")+
  xlab("Time period")+
  labs(title = "Patient - m=70,pa=0.5,T,p1=0.1,p2=0.01,pr=2") +
  theme_bw()

#-------------------------------------------------------------------------------

p7 <- ggplot(num_patient_05_m70_pr2_14[800:1000,], aes(x=prop)) +
 geom_histogram(aes(y=..density..), colour="black", fill="white")+
 geom_density(alpha=.2, fill="#FF6666")+
 labs(title = "Patient - m=70,pa=0.5,T,p1=0.8,p2=0.01,pr=2")+
 theme_bw()

p8 <- ggplot(data = NULL, aes(x = c(1:T), y = as.double(prop))) +
  geom_point(data=num_patient_05_m70_pr2_14,size=0.1) +
  xlab("Time period")+
  ylab("prop")+
  labs(title = "Patient - m=70,pa=0.5,T,p1=0.8,p2=0.01,pr=2") +
  theme_bw()


grid.arrange(p1,p2,p3,p4,p5,p6,p7,p8,nrow=4,ncol=2 )
```

2.2.3 market size m = 70

```
## `stat_bin()` using `bins = 30`. Pick better value with `binwidth`.
## Warning: Removed 1 rows containing missing values (`geom_point()`).
## `stat_bin()` using `bins = 30`. Pick better value with `binwidth`.
## Warning: Removed 1 rows containing missing values (`geom_point()`).
## `stat_bin()` using `bins = 30`. Pick better value with `binwidth`.
## Warning: Removed 1 rows containing missing values (`geom_point()`).
## `stat_bin()` using `bins = 30`. Pick better value with `binwidth`.
## Warning: Removed 1 rows containing missing values (`geom_point()`).
```

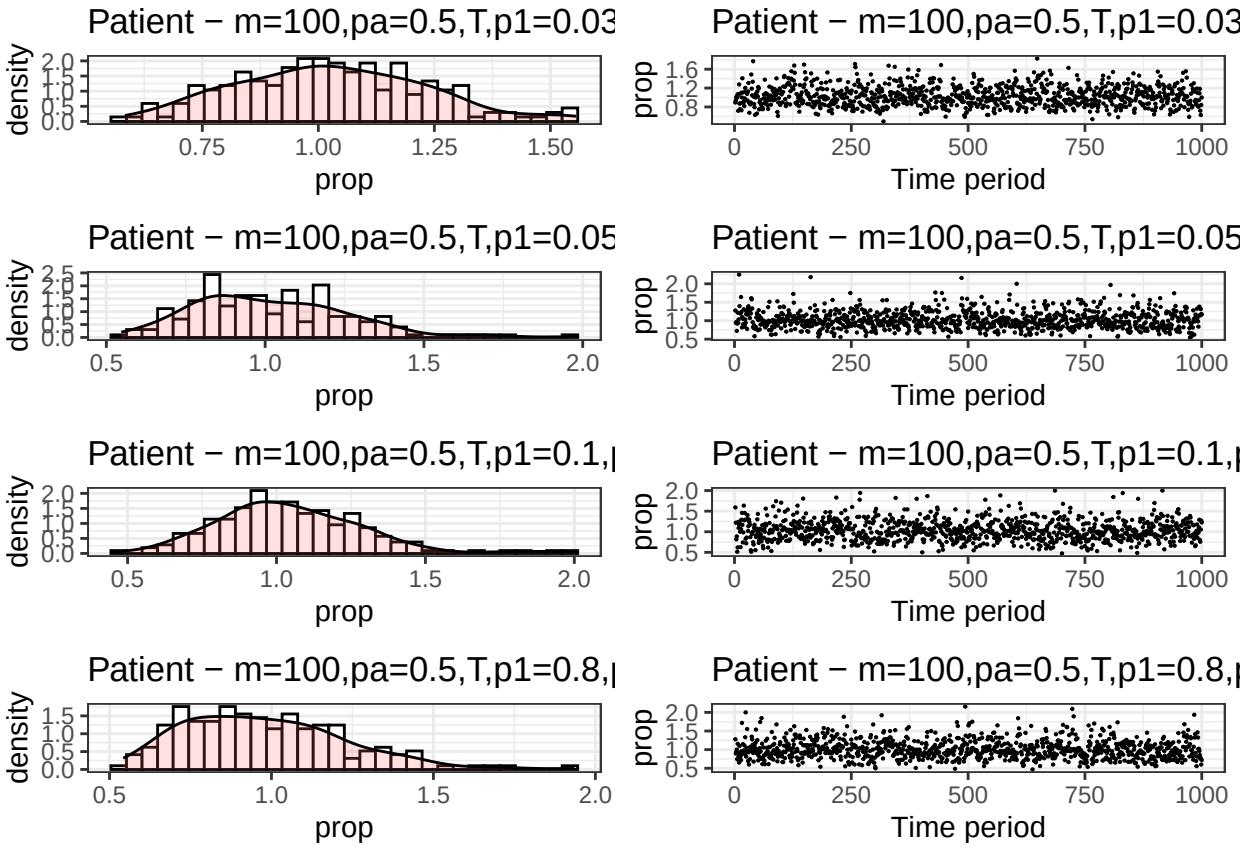



```
p1 <- ggplot(num_patient_05_m100_pr2_11[800:1000,], aes(x=prop)) +
 geom_histogram(aes(y=..density..), colour="black", fill="white")+
 geom_density(alpha=.2, fill="#FF6666")+
 labs(title = "Patient - m=100,pa=0.5,T,p1=0.03,p2=0.01,pr=2")+
 theme_bw()

p2 <- ggplot(data = NULL, aes(x = c(1:T), y = prop)) +
  geom_point(data=num_patient_05_m100_pr2_11,size=0.1) +
  #ylim(0,4)+
  xlab("Time period")+
  labs(title = "Patient - m=100,pa=0.5,T,p1=0.03,p2=0.01,pr=2") +
  theme_bw()

#------------------------------------------------------------------------------

p3 <- ggplot(num_patient_05_m100_pr2_12[800:1000,], aes(x=prop)) +
 geom_histogram(aes(y=..density..), colour="black", fill="white")+
 geom_density(alpha=.2, fill="#FF6666")+
 labs(title = "Patient - m=100,pa=0.5,T,p1=0.05,p2=0.01,pr=2")+
 theme_bw()

p4 <- ggplot(data = NULL, aes(x = c(1:T), y = as.double(prop))) +
  geom_point(data=num_patient_05_m100_pr2_12,size=0.1) +
  #ylim(0,5)+
  ylab("prop")+
```

```
  xlab("Time period")+
  labs(title = "Patient - m=100,pa=0.5,T,p1=0.05,p2=0.01,pr=2") +
  theme_bw()

#-------------------------------------------------------------------------------

p5 <- ggplot(num_patient_05_m100_pr2_13[800:1000,], aes(x=prop)) +
 geom_histogram(aes(y=..density..), colour="black", fill="white")+
 geom_density(alpha=.2, fill="#FF6666")+
 labs(title = "Patient - m=100,pa=0.5,T,p1=0.1,p2=0.01,pr=2")+
 theme_bw()

p6 <- ggplot(data = NULL, aes(x = c(1:T), y = as.double(prop))) +
  geom_point(data=num_patient_05_m100_pr2_13,size=0.1) +
  xlab("Time period")+
  ylab("prop")+
  labs(title = "Patient - m=100,pa=0.5,T,p1=0.1,p2=0.01,pr=2") +
  theme_bw()

#-------------------------------------------------------------------------------

p7 <- ggplot(num_patient_05_m100_pr2_14[800:1000,], aes(x=prop)) +
 geom_histogram(aes(y=..density..), colour="black", fill="white")+
 geom_density(alpha=.2, fill="#FF6666")+
 labs(title = "Patient - m=100,pa=0.5,T,p1=0.8,p2=0.01,pr=2")+
 theme_bw()

p8 <- ggplot(data = NULL, aes(x = c(1:T), y = as.double(prop))) +
  geom_point(data=num_patient_05_m100_pr2_14,size=0.1) +
  xlab("Time period")+
  ylab("prop")+
  labs(title = "Patient - m=100,pa=0.5,T,p1=0.8,p2=0.01,pr=2") +
  theme_bw()


grid.arrange(p1,p2,p3,p4,p5,p6,p7,p8,nrow=4,ncol=2)
```

2.2.4 market size m = 100

```
## `stat_bin()` using `bins = 30`. Pick better value with `binwidth`.
## Warning: Removed 1 rows containing missing values (`geom_point()`).
## `stat_bin()` using `bins = 30`. Pick better value with `binwidth`.
## Warning: Removed 1 rows containing missing values (`geom_point()`).
## `stat_bin()` using `bins = 30`. Pick better value with `binwidth`.
## Warning: Removed 1 rows containing missing values (`geom_point()`).
## `stat_bin()` using `bins = 30`. Pick better value with `binwidth`.
## Warning: Removed 1 rows containing missing values (`geom_point()`).
```



Findings

- According to the plot of proportion of v_A to v_B, most of the distribution of proportion are all right-skewed distribution. In Patient algorithm, the density plots of proportion are all right-skewed distribution; while in Greedy algorithm, some of the density plot of the proportion could not be plotted due to many inf and 0 values, which indicates that one type agents would often vanish (become zero) under steady state. At this time, the dotplot of proportion would be shown as several horizontal lines, which means the value of proportion is among several fixed values. This case happens only when either compatible probability is rather large or newly coming agents arrive in the market in a higher rate.
- Based on these observations, we assume that the distribution of proportion is gamma distribution $\sim\Gamma(\alpha, \beta)$.