Simu_Opt_Bid.R

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```r
library(ggplot2)
```

```
## Warning: package 'ggplot2' was built under R version 3.2.3
```

```r
library(knitr)
```

```
## Warning: package 'knitr' was built under R version 3.2.3
```

```r
library(dplyr)
```

```
## Warning: package 'dplyr' was built under R version 3.2.3
```

```
##
## Attaching package: 'dplyr'
```

```
## The following objects are masked from 'package:stats':
##
##     filter, lag
```

```
## The following objects are masked from 'package:base':
##
##     intersect, setdiff, setequal, union
```

```r
library(magrittr)
```

```
## Warning: package 'magrittr' was built under R version 3.2.3
```

```r
set.seed(1988)

K = 10 #number of suppliers
I = 100
a = c(50000, 200000) #parameter in search cost sc= a * EZ^2 * s_k


D = rbinom(I, 100, 0.5)
#alpha = rbeta(I, shape1 = 2, shape2 =2); hist(alpha)
c = rnorm(I, mean = 100, sd = 10)

WC_raw = rweibull(K, shape = 1, scale = 1)
buyers_visit_order = rank(WC_raw)

optimal_bid_fn = function(buyers_visit_order, S, a){
  order_local = buyers_visit_order
```

```r
  Z_tilda_local = sapply(1:K, function(k){sum(D) - K * mean(S[order_local][1:k])})
  bid_local = (K-2)/(K-1) + Z_tilda_local^2 / a + c[1]
  return(bid_local)
}

loop_over_supply = function(supply_seed, a1, a2){
  S = rbinom(K, supply_seed, 0.5)
  Z = sum(D) - sum(S)
  bid_loop_a1 = optimal_bid_fn(buyers_visit_order, S, a1)
  bid_loop_a2 = optimal_bid_fn(buyers_visit_order, S, a2)
  return(c(bid_loop_a1, bid_loop_a2, Z, a))
}

supply_seed_list = seq(from = 300, to = 950, by = 50)
a_aug = c(rep(a[1], length(supply_seed_list)), rep(a[2], length(supply_seed_list)))


result = mapply(function(x, y, z)loop_over_supply(x, y, z),
                supply_seed_list,
                rep(a[1], length(supply_seed_list)),
                rep(a[2], length(supply_seed_list)))

result = rbind(result, sapply(1: dim(result)[2], function(i)mean(result[1:K,i])))
result = rbind(result, sapply(1: dim(result)[2], function(i)mean(result[(K+1):(2*K),i])))
result = data.frame(t(result[21:25, ]))

bid_stack = c(result[,4], result[,5])
Z_stack = rep(result[,1], 2)
alpha_stack = c(rep(a[1], length(supply_seed_list)), rep(a[2], length(supply_seed_list)))

result_plot = data.frame(cbind(Z_stack,
                               alpha_stack,
                               bid_stack
                               ))
colnames(result_plot) = c("Excess_Demand", "Alpha", "Average_Bid")

#Recall SC = alpha * Z^2 * s_k
ggplot(result_plot, aes(x = Excess_Demand, y = Average_Bid, color = factor(Alpha)))+
  geom_line()+
  geom_point()+
  xlab("Excess Demand")+
  ylab("Average Bid to Suppliers")+
  ggtitle("Single Buyer Average Optimal Bids to Suppliers over Excess Demand")+
  scale_color_manual(name = "  Alpha \n(Parameter in \n search cost)",
                     values=c("#0033CC","#FF0000"))
```
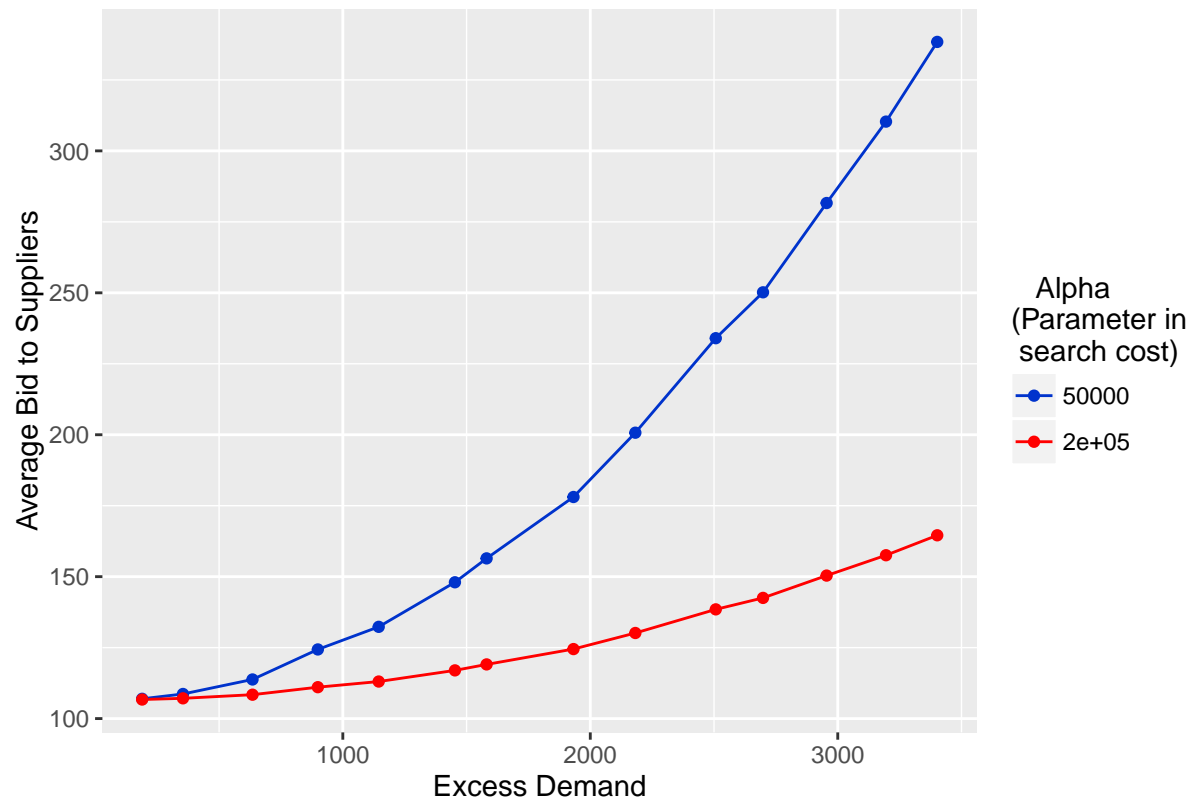
Single Buyer Average Optimal Bids to Suppliers over Excess Demand


```
#
#
# ###################################
# bid_over_supply = result[1:10,]
# excess_demand = data.frame(result[11,])
# bid_over_supply = as.vector(bid_over_supply)
# bid_over_supply = data.frame(cbind(bid_over_supply,
#                                    as.numeric(sapply(supply_seed_list, function(x) rep(x, 10))),
#                                    rep(c(1:K), length(supply_seed_list))
#                                    ))
#
#
#
# colnames(bid_over_supply) = c("bid", "Supply", "Supplier")
#
#
# bid_over_supply %<>%
#   group_by(Supply)
#
# ggplot(bid_over_supply, aes(x = factor(Supplier), y = bid, color = factor(Supply)))+
#   geom_line(aes(group = factor(Supply)))+
#   geom_point()
# #+
# #  scale_color_manual(values=c("#0066FF", "#0033CC", "#33FFFF", "#17FF00", "#99CC00", "#FFCC66", "#FF
#
#
```

```
#
#
#
# #Plot average bid price over supply
# avg_bid_over_supply =
# bid_over_supply%>%
#   group_by(Supply) %>%
#   summarise(mean(bid)) %>%
#   bind_cols(.,excess_demand)
#
# colnames(avg_bid_over_supply) = c('Supply', 'Average_Bid', "Excess_Demand")
#
# ggplot(avg_bid_over_supply, aes(x = Excess_Demand, y = Average_Bid))+
#   geom_line()+
#   geom_point()+
#   ggtitle("Single Buyer Average Optimal Bids at Supplier")
#
#
# #Plot average bid price over supply
```