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Uusing the KDJ as a trading strategy on biotech companies

Shijie Zha
New Jersey Institute of Technology

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ABSTRACT

USING THE KDJ AS A TRADING STRATEGY
ON BIOTECH COMPANIES

by
Shijie Zha

Mean Reversion is the most commonly used model in quantitative trading. This model is associated with several factors, like ma5 and ma10 line. These factors are the most significant in stock markets. However, the disadvantages of this model are lag and inaccuracy.

In this research, we get the historical and current stock data by web crawler, analyze the quantitative data and build a new model involved with the KDJ. Taking biotech companies marketed in the United States and B-share marketed in China as the research subjects, the result shows increased profits compared with the Mean Reversion model. It also shows that as long as we clearly understand the relationship between the turnover and fluctuation of share price, we can find the trading signals more accurately and generate more profit.

USING THE KDJ AS A TRADING STRATEGY
ON BIOTECH COMPANIES

by
Shijie Zha

A Thesis
Submitted to the Faculty of
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in Partial Fulfillment of the Requirements for the Degree of
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BIOGRAPHICAL SKETCH

Author: Shijie Zha

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Undergraduate and Graduate Education:

- Master of Science in Bioinformatics,
  New Jersey Institute of Technology, Newark, NJ, 2016

- Bachelor of Science in Biotechnology,
  University of Florence, Florence, Italy, 2013

Major: Bioinformatics

I dedicate this work to my loved family and the people who helped me.

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CHAPTER 1

INTRODUCTION

1.1 Background Information

Biotechnology affects people's lives. With the increasingly rapid technological development, the impact is even greater. In our daily life, we can see the life with the help of biotechnology, such as medicine, biotechnology, drug effect, less side effect, low toxicity, high safety. In terms of Food, create new varieties to enrich our table, as well as environmental protection, transfer of pollutants in the wastewater using microbial life activities, so that the waste water to be purified. With the development of biological technology, the effect will be more and more. In the future, the development of biological technology development will certainly be more mature, do more benefit to our life. Even Though unique financial challenges faced by biotechnology companies developing therapeutics have contributed to the creation of a highly sensitive market, where stock prices are capable of great fluctuation [2]. The evolution of modern biotechnology is continuing at a rapid pace, so it can be a very worthwhile investment.

Most companies listed on Chinese exchanges will offer two shares classes: A-shares and B-shares. A-Shares on the Shanghai and Shenzhen stock exchanges refer to those that are traded in CNY. In general, foreign individuals are not allowed to directly invest in A-shares as CNY is not a convertible currency and the Capital Account of China is not open yet, while B-shares are quoted in foreign currencies (such as the U.S. dollar) and are open to both domestic and foreign investment (provided that locals set up a foreign currency account). The evidence shows foreign institutional investors are the

main participants in B-share markets [1]. The regular operating hours for the Shanghai Stock Exchange (SSE), Shenzhen Stock Exchange (SZSE), are Monday through Friday from 9:30 a.m. to 11:30 a.m. GMT+08, and 13:00 p.m. to 15:00 p.m. GMT+08.

Finally, we applied our strategy on biotech companies that are marketed in United States and B-share marketed in China to see whether the strategy is suitable.

CHAPTER 2

DATA SET

2.1 Data Description

We want to get the biotech company data of recent 100 trading day. In stock market, they are daily candlestick data, one minute candlestick data and transaction's detail. A daily candlestick is based on the open price, the intraday high and low, and the close. The column names of daily candlestick are open, high, close, low, volume, p_change, ma5 (average price of 5 trading days), ma10 (average price of 10 trading days), ma20 (average price of 20 trading days), v_ma5 (average volume of five trading days), v_ma10 (average volume of 10 trading days), v_ma20 (average volume of 20 trading days), turnover. One minute Candlesticks which is based on the open, the high, the low, and the close price in one minute. The column names of one minute candlestick are date, time, open, high, low, close, volume, amount. Transaction's detail describes the volume traded in a certain price, and the column names are time, price, change, volume, amount, type (Buy or Sell). Every day there are 240 transactions. There are 16322 observations every stock. The monetary unit is US dollar. The format of the data is data frame. In total, there are 300 stocks of Biotech Company and 45 stocks in B-market.

2.2 Method for Getting Dataset

We use web crawler to get the daily and transaction's detail data by using Python and get the one minute data using tdx software.

Table 2.1 Example of Daily Candlestick Data

Date	Open	High	Low	Close	Volume	Amount
2015/10/29	39.98	40.41	39.20	39.95	1796255	71733744.00
2015/10/30	40.29	40.29	38.90	39.29	1729301	68646616.00
2015/11/02	38.10	40.88	38.08	40.02	3104060	123307096.00
2015/11/03	40.20	40.40	39.03	39.88	1674456	66666680.00
2015/11/04	40.28	42.95	40.10	42.60	3900494	163831216.00

Table 2.2 Example of Transaction's Detail

Time	Price	Change	Volume	Amount	Type
15:00:00	6.05	--	8	4840	S
14:59:55	6.05	--	50	30250	S
14:59:35	6.05	--	20	12100	S
14:59:30	6.06	-0.01	165	99825	S
14:59:20	6.05	0.01	4	2424	B

2.3 Method for Getting Every Minute's Data

We use software of securities company(Tong Da Xin) to get the every minute's data which can be extracted by batch, and the format is the following:

Table 2.3 Example of Every Minute's Data

Date	Time	Open	High	Low	Close	Volume	Amount
2015/10/29	0931	39.98	39.98	39.30	39.55	17600	699213.00
2015/10/29	0932	39.59	39.78	39.59	39.59	600	23773.00
2015/10/29	0933	39.59	39.73	39.50	39.73	16700	661010.00
2015/10/29	0934	39.76	39.89	39.76	39.78	15700	625372.00
2015/10/29	0935	39.75	40.20	39.75	40.18	80100	3198831.00

CHAPTER 3

IMPLEMENTATION

3.1 Quantitative and Qualitative Analysis

3.1.1 Daily Random Indicator KDJ Value

There are a total of three lines standing for random indicator in the stock, namely K line, D line and the J line. Random indicator not only considers the highest price, the lowest price in the calculation period, but also takes into account of the random amplitude in the course of the fluctuation of stock price. Therefore, researchers always think that random indicator can more truly reflect the volatility of stock price, and it plays an important role in prompting [3].

To calculate the k value, d value and j value, we need to calculate the rsv first:

rsv = (Close price -Low)/(High -Low)*100, which Close price is the price of last second in one minute, High represents the highest price in the last 9 days, and low represents the lowest price in the last 9 days,

For the first day of our data, we use these formulas to calculate the k value, d value and j value:

$$k = 2/3 \ \text{x} 50 + 1/3 \ \text{x rsv} \tag{3.1}$$

$$d = 2/3 \ \text{x} 50 + 1/3 \ \text{x k} \tag{3.2}$$

$$j = 3\text{x k} - 2 \ \text{x d} \tag{3.3}$$

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For the other days in our data, we use these formulas to calculate the k value, d value and j value:

$$k = 2/3 \ \times k^* + 1/3 \times rsv \tag{3.4}$$

$$d = 2/3 \times d^* + 1/3 \times k \tag{3.5}$$

$$j = 3 \times k - 2 \times d \tag{3.6}$$

k^* represents the k value from last day, and d^* represents the d value from the last day. When High is equal to Low in denominate in this formula rsv = (Close price - Low)/(High -Low)*100, then rsv is NA, so we can't calculate the k value. Then we get the k value from k value from last day.

After we calculate the k value, d value, and j value, we can draw the kdj line. In order to know the accuracy of these calculations, we compare our kdj to the securities company's kdj in the software.
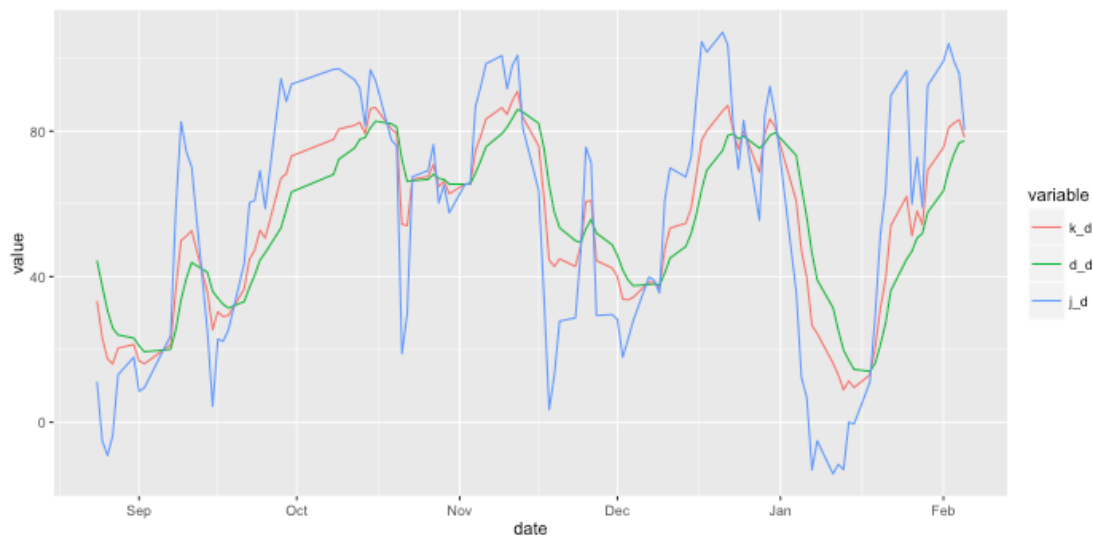
Figure 3.1.1 Example of daily kdj line from 09/2015 to 02/2016.

3.1.2 K, D, J Value of Every Minute

To calculate the k value, d value and j value, we need to calculate the rsv first:

rsv^1 = (Close price -Low)/(High -Low)*100

Close price is the price of last second in one minute, and High represents the highest price in the last 9 minutes, and low represents the lowest price in the last 9 minutes,

For the first minute, we use these formulas to calculate the k^1 value, d^1 value and j^1 value:

$$k^1 = 2/3 \ x50 + 1/3 \ x \ rsv^1 \tag{3.7}$$

$$d^1 = 2/3 \ x50 + 1/3 \ xk^1 \tag{3.8}$$

$$j^1 = 3x \ k^1 - 2xd^1 \tag{3.9}$$

For the other minutes, we use these formulas to calculate the k^1 value, d^1 value and j^1 value:

$$k^1 = 2/3 \ x \ k^1* + 1/3 \ x \ rsv^1 \tag{3.10}$$

$$d^1 = 2/3 \ x \ d^1* + 1/3 \ x \ k^1 \tag{3.11}$$

$$j^1 = 3 \ x \ k^1 - 2 \ x \ d^1 \tag{3.12}$$

k^1* represents the k^1 value from last minute, and d^1* represents the d^1 value from the last minute. When High is equal to Low in denominate in this formula $rsv^1 = $ (Close price -Low)/ (High -Low)*100, so rsv^1 is NA. If we can't calculate the k^1 value, we take get the k^1 value from k^1 value from last minute.
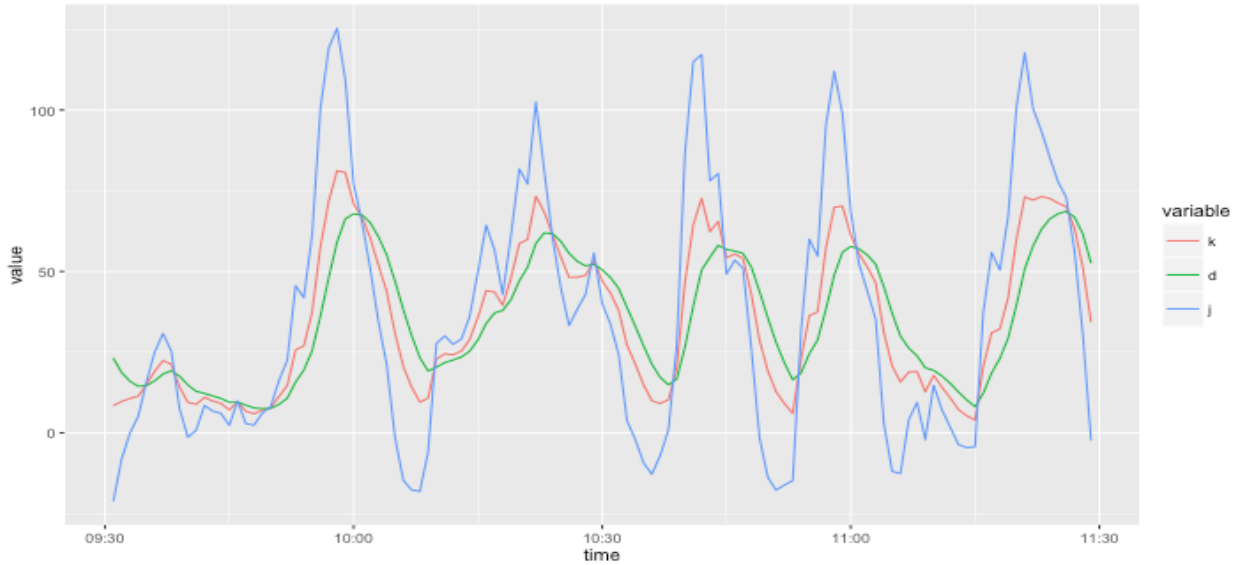
Figure 3.1.2 Example of one-minute kdj line from 01/04/2016 to 01/04/2016.

3.1.3 Moving Average

The most popular indicator is the moving average. This shows the average price over a period of time. For a 30-day moving average you add the closing prices for each of the 30 days and divide by 30. The most common averages are 20, 30, 50, 100, and 200 days. Longer time spans are less affected by daily price fluctuations. A moving average is plotted as a line on a graph of price changes. When prices fall below the moving average they have a tendency to keep on falling. Conversely, when prices rise above the moving average they tend to keep on rising [5]. To calculate the moving average of one stock, we

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use this formula: MA(n) =(C1+C2+C3+C4+C5.....+Cn)/n, in which C is the close price of one day, n is the number of recent trading days. Here we calculate the MA(5),MA(10).
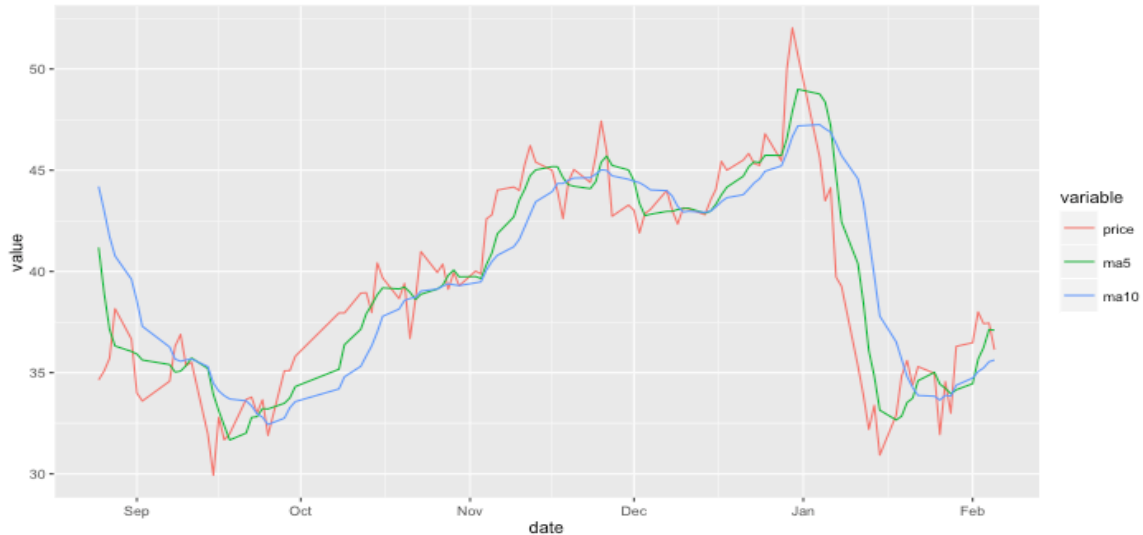
Figure 3.1.3 Example of ma5, ma10 and price lines from 09/2015 to 02/2016.

3.2 Trading Simulation

Good prediction precision/accuracy does not guarantee a high investment return [3], so we don't develop an algorithm to predict the fluctuation of the share price. However, we try to figure out a strategy of trading which may be used to higher profits than buy-and-hold strategy.

A trading simulation was developed in an effort to further examine if the neural network models could practically be used to generate higher profits than those earned either by employing the traditional regression model or by simply following a buy-and-hold (passive) investment strategy.

Here, we define several key points at which we will preform different actions when these key points appear or disappear.

When the K-line, D-line, J-line up-cross each other, and the K, D, J values are less than 30, and we define that intersection is a golden cross of KDJ. This so-called golden cross is seen as a signal of oversold. When a golden cross appears, we buy the stock in next minute, which is called buy point.

When the K-line, D-line, and J-line down-cross each other, and the K, D, J values are greater than 70, then we define that intersection is a death cross of KDJ. This so-called death cross is seen as a signal of overbought. When a death cross appears, we sell the stock in next minute, which is called sell point. Actually, in this model, we don't sell the share second the death point, but second the rate of return, which is 120%. For example, after we buy the stock at 1 dollar, we sell the stock at the price of 1 x 120%. About when we enter the market, there are two key points. First, after the day-kdj appears the golden points, we enter the market.

Second, when the 5-day simple moving average of price is below the 10-day moving average, we don't buy any share. If we have bought several shares in the previous trading day, we also sell the whole share when MA5 is below MA10. However, when the 5-day simple moving average of price is above the 10-day moving average, we buy the share.

A trading simulation was developed to further examine if this strategy could be used to generate higher profits [4].

CHAPTER 4

RESULTS

We applied this strategy on bio-tech companies marketed in the United States to see whether this strategy is available in United States, and the results show below.

Table 4.1 Results of Strategy Involved with Moving Average

code	start_date	start	stop_date	stop	profit
BIIB	12/28/15	303.82	3/24/16	255.74	466.13
ICPT	12/28/15	154.85	3/24/16	128.01	257.88
JAZZ	12/28/15	140.67	3/24/16	121.89	214.05
EGRX	12/28/15	86.25	3/24/16	42.42	184.93
INCY	12/28/15	108.76	3/24/16	69.54	181.1
MDVN	12/28/15	48	3/24/16	38.38	146.84
LGND	12/28/15	107.3	3/24/16	103.96	138.5
ALNY	12/28/15	90.79	3/24/16	61.21	110.7
ILMN	12/28/15	188.23	3/24/16	155.19	96.42
GWPH	12/28/15	68.84	3/24/16	85.75	96.28
MNK	12/28/15	75.05	3/24/16	60.1	79.94
CXRX	12/28/15	41.63	3/24/16	30.13	74.71
CBPO	12/28/15	141.11	3/24/16	111.56	70.86
CBM	12/28/15	47.55	3/24/16	42.17	70.46
BMRN	12/28/15	104.75	3/24/16	84.04	70.02
ALKS	12/28/15	80.05	3/24/16	32.23	63.91
GILD	12/28/15	101.29	3/24/16	91.02	61.01
AGN-A	12/28/15	1023.1	3/24/16	942.74	59.7
ANIP	12/28/15	46.82	3/24/16	33.63	59.29
MRK	12/28/15	52.3	3/24/16	53.27	57.92
CTLT	12/28/15	24.85	3/24/16	26.6	55.23
ANIK	12/28/15	38.84	3/24/16	45.49	55.06
ABBV	12/28/15	58.03	3/24/16	56.92	54.88
FPRX	12/28/15	41.3	3/24/16	37.59	52.2
MRTX	12/28/15	31.71	3/24/16	21.93	43.38
JUNO	12/28/15	44.09	3/24/16	40.14	42.03
EBS	12/28/15	39.23	3/24/16	34.55	39.17
MCRB	12/28/15	34.85	3/24/16	25.28	37.95
AKRX	12/28/15	36.4	3/24/16	25.15	36.82
BXLT	12/28/15	38.81	3/24/16	40	34.46
EPZM	12/28/15	17.1	3/24/16	11.2	34.1
ALXN	12/28/15	188.74	3/24/16	133.12	33.81
KITE	12/28/15	61.67	3/24/16	44.68	33.43
FOLD	12/28/15	9.56	3/24/16	8.08	30.47
MDCO	12/28/15	36.4	3/24/16	32.07	29.83
MGNX	12/28/15	30.34	3/24/16	17.42	29.39
ENTA	12/28/15	32.66	3/24/16	27.72	29.12
LXRX	12/28/15	13.13	3/24/16	12.09	28.26
BPMC	12/28/15	24.35	3/24/16	16.71	27.65

Table 4.1 (Continued) Results of Strategy Involved with Moving Average

code	start_date	start	stop_date	stop	profit
ATRA	12/28/15	23.1	3/24/16	18.05	22.39
ARIA	12/28/15	6.37	3/24/16	6.49	21.91
NBIX	12/28/15	53.28	3/24/16	37.37	21.05
CBMG	12/28/15	22	3/24/16	16.63	20.94
AQXP	12/28/15	12.48	3/24/16	8.65	19.08
AERI	12/28/15	23.33	3/24/16	12.35	18.44
NLNK	12/28/15	36.52	3/24/16	18.32	18.17
CHMA	12/28/15	20.19	3/24/16	9.87	18.06
HALO	12/28/15	16.9	3/24/16	9.13	17.25
MYL	12/28/15	54.25	3/24/16	45.88	16.82
MACK	12/28/15	8.15	3/24/16	8.46	16.74
IDXX	12/28/15	73.8	3/24/16	76.06	15.19
LOXO	12/28/15	29.45	3/24/16	23.76	14.26
DVAX	12/28/15	26.01	3/24/16	18.98	14.12
ESPR	12/28/15	22.35	3/24/16	15.9	13.72
IRWD	12/28/15	11.48	3/24/16	10.57	12.65
IMGN	12/28/15	13.44	3/24/16	8.46	12.55
CEMP	12/28/15	31.15	3/24/16	15.95	12.53
IPXL	12/28/15	43.65	3/24/16	33.08	12.21
CLLS	12/28/15	30.02	3/24/16	27.45	11.56
ANTH	12/28/15	4.54	3/24/16	3.61	11.28
FWP	12/28/15	18.8	3/24/16	16.42	11.16
AKBA	12/28/15	12.11	3/24/16	8.72	10.97
DERM	12/28/15	34.47	3/24/16	20.25	10.96
HRTX	12/28/15	28.42	3/24/16	17.1	10.93
CERS	12/28/15	6.48	3/24/16	5.96	10.88
AFMD	12/28/15	7.2	3/24/16	3.81	10.72
CPXX	12/28/15	1.76	3/24/16	11.56	10.7
AAVL	12/28/15	9.29	3/24/16	5.22	10.45
BMY	12/28/15	68.05	3/24/16	62.14	9.65
ARGS	12/28/15	2.36	3/24/16	4.84	9.15
KPTI	12/28/15	13.75	3/24/16	9.1	9.11
IMDZ	12/28/15	21.35	3/24/16	12.15	9.1
NAII	12/28/15	10.71	3/24/16	11.89	8.7
CALA	12/28/15	8.12	3/24/16	5.84	8.45
INFI	12/28/15	7.8	3/24/16	5.54	8.39
BCRX	12/28/15	10.58	3/24/16	2.83	8.09
DEPO	12/28/15	18.54	3/24/16	13.5	7.96
NK	12/28/15	16.65	3/24/16	8.7	7.58
EXEL	12/28/15	5.46	3/24/16	3.94	7.42
AST	12/28/15	4.1	3/24/16	4.99	7
AGTC	12/28/15	20.72	3/24/16	14.44	6.74
IMMU	12/28/15	3.18	3/24/16	2.69	6.7
AGEN	12/28/15	4.66	3/24/16	4.14	6.53
AGRX	12/28/15	8.36	3/24/16	6.15	6.48
EARS	12/28/15	4.63	3/24/16	3.75	6.26
AKTX	12/30/15	14.06	3/24/16	13.97	6
ENDP	12/28/15	61.46	3/24/16	30.52	5.99
MNOV	12/28/15	3.55	3/24/16	5.78	5.8
MNKD	12/28/15	1.5	3/24/16	2.16	5.79
ARDX	12/28/15	18.8	3/24/16	7.59	5.62
LJPC	12/28/15	28.31	3/24/16	19.97	5.09
ATHX	12/28/15	1.07	3/24/16	2.78	4.81

Table 4.1 (Continued) Results of Strategy Involved with Moving Average

code	start_date	start	stop_date	stop	profit
ACHN	12/28/15	10.08	3/24/16	7.25	3.79
ITCI	12/28/15	56.04	3/24/16	26.9	3.78
CGEN	12/28/15	6.53	3/24/16	5.91	3.68
LPCN	12/28/15	12.95	3/24/16	10.84	3.66
INO	12/28/15	7.04	3/24/16	7.77	3.51
NDRM	12/28/15	16.61	3/24/16	13.82	3.47
FLKS	12/28/15	12.42	3/24/16	11.88	3.46
INSY	12/28/15	28.5	3/24/16	18.33	3.45
ADMA	12/28/15	8.57	3/24/16	6.23	3.43
ABUS	12/28/15	4.64	3/24/16	4.2	3.34
NERV	12/28/15	5.84	3/24/16	6.18	3.27
GLMD	12/29/15	7.99	3/24/16	4.46	3.21
BTX	12/28/15	4.21	3/24/16	2.67	2.91
CBIO	12/28/15	2.61	3/24/16	1.79	2.78
JAGX	12/28/15	2.28	3/24/16	1.61	2.73
EPRS	12/28/15	3.62	3/24/16	2.86	2.64
CLCD	12/28/15	8.14	3/24/16	6.13	2.37
CHRS	12/28/15	22.4	3/24/16	19.5	2.34
MDGN	12/28/15	6.05	3/24/16	4.6	2.26
IPCI	12/29/15	2.01	3/24/16	2.1	2.07
CYAN	12/30/15	5.15	3/24/16	4.99	2.05
ADMP	12/28/15	5.4	3/24/16	6	1.89
AEZS	12/28/15	4.87	3/24/16	3.57	1.79
APRI	12/28/15	1.07	3/24/16	1.07	1.76
BIND	12/28/15	2.42	3/24/16	2.4	1.75
ASMB	12/28/15	8.2	3/24/16	5.65	1.65
DRRX	12/28/15	2.22	3/24/16	1.42	1.57
BUR	1/11/16	1.48	3/24/16	2.78	1.55
ARNA	12/28/15	1.96	3/24/16	1.97	1.39
ATNM	12/28/15	2.86	3/24/16	2.11	1.32
JNP	12/28/15	10.05	3/24/16	6.88	1.32
GNCA	12/28/15	5.8	3/24/16	4.36	1.29
DSCO	12/28/15	3.28	3/24/16	1.64	1.23
ALQA	12/28/15	2.14	3/24/16	0.85	1.18
CANF	12/28/15	3.22	3/24/16	2.82	1.17
BPTH	12/28/15	1.47	3/24/16	2.08	1.16
CATB	12/29/15	8.63	3/24/16	5.75	1.09
AMPE	12/28/15	3.5	3/24/16	2.17	1.04
FATE	12/29/15	3.51	3/24/16	1.87	0.99
ACUR	12/29/15	2.61	3/24/16	2.41	0.96
MDWD	12/28/15	9.07	3/24/16	7.78	0.91
CEMI	12/28/15	5.24	3/24/16	5.62	0.9
BCLI	12/28/15	2.78	3/24/16	2.73	0.88
CPRX	12/28/15	2.4	3/24/16	1.28	0.84
CAPR	12/28/15	3	3/24/16	2.95	0.83
EBIO	12/28/15	2.82	3/24/16	0.4	0.83
KMDA	12/31/15	4.07	3/24/16	3.9	0.82
CYTR	12/28/15	2.78	3/24/16	2.71	0.8
ADAP	12/28/15	10.82	3/24/16	8.4	0.8
CLSN	12/28/15	1.94	3/24/16	1.5	0.79
EVOK	12/29/15	3.41	3/24/16	4.69	0.77
HZNP	12/28/15	21.77	3/24/16	16.19	0.75
AMRN	12/28/15	1.91	3/24/16	1.47	0.68
GLYC	12/28/15	6.24	3/24/16	6.25	0.68

Table 4.1 (Continued) Results of Strategy Involved with Moving Average

code	start_date	start	stop_date	stop	profit
ECYT	12/28/15	4	3/24/16	3.38	0.53
CLBS	12/28/15	1.13	3/24/16	0.85	0.48
ABIO	12/29/15	5.03	3/24/16	3.75	0.48
KIN	12/28/15	3.74	3/24/16	3.54	0.45
ATOS	12/28/15	0.36	3/24/16	0.34	0.42
BVXV	12/30/15	3.88	3/21/16	3.67	0.37
ARDM	12/28/15	3.68	3/24/16	4.12	0.37
APTO	12/28/15	2.61	3/24/16	2.95	0.35
CASI	12/29/15	0.98	3/24/16	1.45	0.33
CELGZ	12/28/15	1.12	3/24/16	1.16	0.29
ICCC	12/29/15	7.39	3/24/16	6.5	0.29
FCSC	12/28/15	4.66	3/24/16	2.63	0.25
CRBP	12/28/15	1.63	3/24/16	1.85	0.22
NEOT	12/28/15	1.59	3/24/16	0.67	0.22
CVM	12/28/15	0.38	3/24/16	0.56	0.2
MCUR	12/28/15	1.34	3/24/16	0.99	0.2
ARQL	12/28/15	2.27	3/24/16	1.73	0.17
CYCC	12/28/15	0.56	3/24/16	0.44	0.16
GTXI	12/28/15	0.74	3/24/16	0.6	0.16
GALT	12/28/15	1.78	3/24/16	1.4	0.14
ENZN	12/28/15	0.61	3/24/16	0.44	0.12
BIOD	12/28/15	0.29	3/24/16	0.33	0.11
ACST	12/29/15	2.61	3/24/16	1.48	0.1
AVEO	12/28/15	1.25	3/24/16	0.99	0.1
CPIX	12/29/15	5.4	3/24/16	4.55	0.06
CLRB	12/28/15	0.77	3/23/16	4.95	0.05
MEIP	12/28/15	1.75	3/24/16	1.2	0.05
ALDX	12/28/15	6.93	3/24/16	4.53	0.04
APPY	12/29/15	0.3	3/24/16	0.31	0.04
IMUC	12/28/15	0.38	3/24/16	0.31	0.04
HEB	12/30/15	0.08	3/24/16	0.15	0.03
AKAO	12/28/15	6.04	3/24/16	3.18	0.01
DCTH	12/28/15	0.55	3/24/16	0.29	0
IBIO	12/28/15	0.6	3/24/16	0.57	-0.01
CPHI	12/30/15	0.15	3/24/16	0.22	-0.02
EYEG	12/28/15	2.88	3/24/16	3.25	-0.02
BLRX	12/28/15	1.31	3/24/16	1.23	-0.03
ALXA	12/28/15	0.73	3/24/16	0.54	-0.03
GNVC	12/28/15	1.8	3/24/16	0.89	-0.05
BOTA	12/28/15	2.08	3/24/16	1.52	-0.06
GERN	12/28/15	4.87	3/24/16	2.91	-0.06
CDXS	12/28/15	4	3/24/16	3.01	-0.07
CBYL	12/28/15	3.81	3/24/16	0.66	-0.08
LPTN	12/29/15	0.2	3/24/16	0.19	-0.09
ARWR	12/28/15	6.26	3/24/16	4.82	-0.11
NAVB	12/28/15	1.39	3/24/16	0.99	-0.12
MSLI	12/29/15	1.58	3/24/16	1.39	-0.13
MYOS	12/28/15	1.84	3/22/16	1.63	-0.14
CTIC	12/28/15	1.33	3/24/16	0.55	-0.16
AXN	12/28/15	0.95	3/24/16	0.73	-0.16
CLDN	12/28/15	1.5	3/22/16	1.13	-0.16
BPMX	12/28/15	1.48	3/22/16	1.35	-0.17
CUR	12/28/15	1.12	3/24/16	0.79	-0.17
FBIO	12/28/15	2.92	3/24/16	3.02	-0.19

Table 4.1 (Continued) Results of Strategy Involved with Moving Average

code	start_date	start	stop_date	stop	profit
NEPT	12/28/15	1.11	3/24/16	1.07	-0.25
CYTX	12/28/15	0.19	3/24/16	0.19	-0.26
IMNP	12/28/15	0.82	3/24/16	0.5	-0.26
AUPH	12/28/15	2.5	3/24/16	3.04	-0.26
BLPH	12/28/15	3.09	3/24/16	2.75	-0.27
INNL	12/30/15	8.34	3/24/16	8.5	-0.36
CRMD	12/28/15	2.09	3/24/16	2.43	-0.37
MSTX	12/28/15	0.42	3/24/16	0.26	-0.45
CSBR	1/14/16	3.85	3/10/16	3.7	-0.45
CORT	12/28/15	4.99	3/24/16	4.39	-0.47
ITEK	12/28/15	11.34	3/24/16	7.13	-0.49
FGEN	12/28/15	30.75	3/24/16	19.47	-0.5
CRIS	12/28/15	2.86	3/24/16	1.6	-0.57
GALE	12/28/15	1.53	3/24/16	1.16	-0.62
NKTR	12/28/15	16.9	3/24/16	12.87	-0.65
CFRX	12/28/15	4.8	3/24/16	3.59	-0.8
MRNS	12/28/15	7.72	3/24/16	4.79	-0.81
EVGN	12/28/15	8.57	3/18/16	6.57	-0.84
ARRY	12/28/15	4.34	3/24/16	2.84	-0.86
DBVT	12/28/15	35.29	3/24/16	31.98	-0.89
IMMY	12/28/15	6.85	3/24/16	4.2	-0.92
CBLI	12/28/15	3.66	3/24/16	2.57	-0.93
CRME	12/28/15	7.69	3/24/16	4.26	-1.05
DRNA	12/28/15	11.86	3/24/16	5.23	-1.13
NBY	12/28/15	2.23	3/24/16	2.27	-1.18
GBIM	12/28/15	4.81	3/24/16	1.73	-1.19
DPRX	12/28/15	11.27	3/24/16	7.15	-1.2
APHB	12/29/15	3.89	3/24/16	4.86	-1.22
CYNA	12/28/15	15.12	3/24/16	11.96	-1.27
ENZY	12/28/15	9.98	3/24/16	8.26	-1.29
CTRV	12/28/15	1.6	3/24/16	1.67	-1.34
ABEO	12/28/15	3.61	3/24/16	2.82	-1.53
CNAT	12/28/15	3	3/24/16	2.1	-1.54
BNTC	12/29/15	4.19	3/24/16	1.75	-1.56
CMRX	12/28/15	6.95	3/24/16	4.96	-2.1
EPIX	1/5/16	4.65	3/24/16	3.34	-2.16
FOMX	12/28/15	7.88	3/24/16	6.21	-2.32
ASND	12/28/15	17.87	3/24/16	17.61	-2.53
LBIO	12/28/15	7.58	3/24/16	4.96	-2.53
LIFE	12/28/15	10	3/24/16	5.31	-2.54
BSTC	12/28/15	41.49	3/24/16	34.51	-2.55
AXON	12/28/15	19.01	3/24/16	11.41	-2.68
ADXS	12/28/15	11.58	3/24/16	9.36	-2.9
AGN	12/28/15	310.03	3/24/16	277.41	-3.04
ADHD	12/28/15	5.97	3/24/16	4.1	-3.05
HSGX	12/28/15	3.04	3/24/16	2.45	-3.35
FLML	12/28/15	14.55	3/24/16	11.46	-3.4
DNAI	12/28/15	14.99	3/24/16	7.06	-3.42
JNJ	12/28/15	102.31	3/24/16	107.76	-3.74
IDRA	12/28/15	3.23	3/24/16	2.05	-3.77
KERX	12/28/15	5.34	3/24/16	4.66	-3.81
CDTX	12/28/15	16.35	3/24/16	10.5	-3.95
EGLT	12/28/15	10.91	3/24/16	6.9	-4.24
AMPH	12/28/15	14.22	3/24/16	12.18	-4.59

Table 4.1 (Continued) Results of Strategy Involved with Moving Average

code	start_date	start	stop_date	stop	profit
BDSI	12/28/15	5.16	3/24/16	2.91	-6.03
CCXI	12/28/15	8.21	3/24/16	2.46	-6.18
AEGR	12/28/15	10.16	3/24/16	3.85	-6.63
GBT	12/28/15	32.83	3/24/16	16.12	-6.88
MNTA	12/28/15	15.17	3/24/16	9.19	-6.96
AMRI	12/28/15	19.88	3/24/16	14.4	-9.01
HTBX	12/29/15	2.63	3/24/16	0.69	-9.14
FLXN	12/28/15	19.25	3/24/16	8.75	-10.38
CYAD	12/28/15	50.32	3/24/16	47.83	-11.97
COLL	12/28/15	25.4	3/24/16	17.05	-12.94
CNCE	12/28/15	19.2	3/24/16	13.5	-13.09
GSK	12/28/15	39.74	3/24/16	39.54	-14.19
INSM	12/28/15	18.41	3/24/16	12.66	-14.85
NEOS	12/28/15	13.76	3/24/16	11.04	-16.48
ADMS	12/28/15	30.14	3/24/16	14.06	-16.66
ADRO	12/28/15	27.86	3/24/16	13.09	-16.75
CLVS	12/28/15	33.24	3/24/16	20.54	-17.23
CARA	12/28/15	15.21	3/24/16	6.32	-19.08
CLDX	12/28/15	16.19	3/24/16	3.77	-19.1
DPLO	12/28/15	33.34	3/24/16	27.48	-20.67
ACAD	12/28/15	34.95	3/24/16	22.17	-27.6
AMAG	12/28/15	30.12	3/24/16	21.59	-28.77
LCI	12/28/15	41.2	3/24/16	21	-29.43
GLPG	12/28/15	62.27	3/24/16	42.55	-32.98
AZN	12/28/15	33.16	3/24/16	28.16	-36.42
LLY	12/28/15	84.86	3/24/16	71.23	-39.09
CELG	12/28/15	119.39	3/24/16	101.62	-44.15
BLUE	12/28/15	66.3	3/24/16	44.21	-45.33
ACOR	12/28/15	42.7	3/24/16	27.39	-46.71
IONS	12/28/15	61.01	3/24/16	43.47	-55.14
AMGN	12/28/15	160.03	3/24/16	150.21	-58.62
AGIO	12/28/15	64.55	3/24/16	39.29	-58.83
GRFS	12/28/15	32.47	3/24/16	15.29	-137.58
ANAC	12/28/15	105.23	3/24/16	58.42	-273.29

From Table 4.1, 62% of shares are profitable, but this percentage is unsatisfactory. After reviewing most of the trading records, we find this strategy has some defects. Because ma5 takes a few days to down-cross the ma10, this lag will influence the trading. When the share price keeps on dropping in two days, the ma5 and ma10 will not react quickly enough. Because of the lag of the ma5 and ma10, we developed another strategy which can response quickly and lead to loss less money lost.

When a golden cross appears, the price of share will rise, so we buy the share in

three days after golden cross appears, and sell them in the next three days. This interval

of transaction will be finished in 5 days. After 5 days, the probability of dropping of the

share price is much greater than the increasing. However, if the price still rise, the golden

cross will appear again, we can repeat the transaction described above.

We applied this strategy on bio-tech companies marketed in the United States to

see whether this strategy is availability in United States, and the results are show below.

Table 4.2 Results of Strategy Involved with KDJ in Market of US

code	start_date	start	stop_date	stop	profit
AAVL	01/20/16	5.91	03/23/16	4.98	6.77
ABBV	01/14/16	51.46	03/23/16	56.37	19.01
ABEO	01/14/16	2.95	03/03/16	2.25	1.09
ABIO	01/13/16	3.72	03/22/16	3.87	0.54
ABUS	01/20/16	3.28	03/24/16	3.95	3.59
ACAD	12/28/15	34.83	03/24/16	19.88	19.06
ACHN	01/25/16	7.63	03/23/16	7.21	3.39
ACOR	01/19/16	37.66	03/04/16	36.67	25.79
ACST	01/19/16	1.63	03/07/16	1.79	0.19
ACUR	01/21/16	1.85	03/16/16	2.14	0.1
ADAP	01/21/16	8.05	03/23/16	7.81	7.11
ADHD	01/19/16	5.06	03/23/16	3.83	3.27
ADMA	01/26/16	6.11	02/24/16	4.42	0.41
ADMP	01/25/16	4.44	03/21/16	5.48	0.55
ADMS	01/14/16	25.77	03/24/16	13.89	-1.95
ADRO	01/04/16	26.19	03/23/16	12.59	-11.98
ADXS	01/21/16	7.13	03/03/16	7.78	11.14
AEGR	01/14/16	7.58	03/02/16	5.84	7.31
AERI	12/30/15	24.54	03/23/16	11.68	-3.35
AEZS	01/19/16	3.52	03/07/16	4.03	5.37
AFMD	01/19/16	3.4	03/24/16	3.69	10.13
AGEN	01/20/16	2.99	03/23/16	3.87	4.29
AGIO	01/20/16	45.25	03/23/16	38.29	91.98
AGN-A	02/09/16	907.16	02/10/16	923.5	53.81
AGN	01/14/16	297.78	03/24/16	280.15	80.25
AGRX	01/25/16	6.26	03/23/16	5.78	6.21
AGTC	01/20/16	14.37	03/24/16	13.53	11.2
AIMT	01/20/16	13.89	03/07/16	17.74	19.01
AKAO	01/25/16	4.37	03/07/16	3.95	0.81
AKBA	01/20/16	7.69	03/07/16	8.21	10.59
AKRX	01/26/16	28.05	03/23/16	24.68	34.53
AKTX	01/05/16	14	03/10/16	8.85	5.23
ALDR	01/12/16	27.83	03/23/16	17.75	31.5
ALDX	01/05/16	6.68	03/16/16	4.74	-1.18
ALIM	01/05/16	2.63	03/18/16	1.81	-0.38
ALKS	02/01/16	32.4	03/22/16	32.61	45.01

Table 4.2 (Continued) Results of Strategy Involved with KDJ in Market of US

code	start_date	start	stop_date	stop	profit
ALXA	01/11/16	0.55	03/23/16	0.54	-0.2
ALXN	12/28/15	189.18	03/24/16	132.49	236.96
AMAG	01/20/16	23.32	03/23/16	20.88	2.9
AMGN	12/28/15	160.16	03/17/16	142.77	-19.88
AMPE	01/21/16	2.09	03/23/16	2.21	1.43
AMPH	12/29/15	14.24	03/16/16	12.18	-7.12
AMRI	12/29/15	19.91	03/24/16	13.89	-4.36
AMRN	01/04/16	1.85	02/22/16	1.37	0.23
ANAC	12/29/15	107.38	03/11/16	62.14	100.01
ANIK	01/05/16	38.5	03/23/16	45.18	12.22
ANIP	01/20/16	33.15	03/23/16	33.11	27.58
ANTH	12/29/15	4.5	03/07/16	4.38	7.98
APHB	01/14/16	2.82	03/22/16	5.08	0.1
APPY	01/07/16	0.29	03/17/16	0.28	0.08
APRI	01/13/16	0.84	03/17/16	1.12	1.62
APTO	01/25/16	2.49	03/23/16	3.05	0.52
AQXP	01/19/16	9.12	03/17/16	8.13	10.12
ARDM	01/12/16	3.61	02/26/16	3	0.12
ARDX	01/19/16	10.55	03/23/16	7.32	11.7
ARGS	01/06/16	2.28	03/23/16	5.01	5.12
ARIA	01/12/16	5.66	03/23/16	6.43	1.18
ARNA	01/13/16	1.62	03/23/16	1.83	1.17
ARQL	01/20/16	1.79	03/23/16	1.62	0.3
ARRY	01/12/16	3.49	03/24/16	2.8	1.71
ARWR	01/20/16	3.55	03/24/16	4.57	2.52
ASMB	12/28/15	7.81	03/08/16	6	3.26
ASND	12/28/15	17.9	03/09/16	17.67	3.59
AST	12/29/15	4.1	03/23/16	5.04	1.03
ATHX	01/11/16	1.28	03/16/16	2.3	0.46
ATNM	01/11/16	2.37	03/22/16	2.21	0.54
ATOS	01/04/16	0.31	03/15/16	0.34	0.42
ATRA	12/28/15	23.19	03/23/16	16.84	27.96
AUPH	01/05/16	2.51	03/02/16	2.36	0.74
AVEO	01/20/16	0.99	02/18/16	0.94	0.16
AXN	01/05/16	0.64	03/22/16	0.72	-0.05
AXON	12/30/15	19.44	03/23/16	11.29	-3.86
AZN	12/28/15	33.14	03/11/16	29.57	2.84
BCLI	01/14/16	1.95	03/03/16	2.44	0.01
BCRX	01/19/16	7.29	03/24/16	2.77	6.86
BDSI	12/28/15	5.21	03/23/16	2.88	-4.02
BIIB	01/14/16	277.28	03/24/16	253.56	418.66
BIND	01/04/16	2.31	03/22/16	1.98	1.54
BIOD	01/20/16	0.25	02/03/16	0.26	0.01
BLCM	01/20/16	11.77	03/24/16	7.96	1.65
BLPH	01/14/16	2.39	02/25/16	2.18	-0.77
BLRX	01/04/16	1.3	03/22/16	1.12	-0.24
BLUE	01/20/16	40.57	03/23/16	41.71	74.78
BMRN	01/21/16	82.37	03/23/16	82.58	25.37
BMY	12/28/15	67.94	02/11/16	59.18	-14.28
BNTC	01/11/16	4.05	02/22/16	3.6	-1.56
BOTA	12/29/15	1.97	03/22/16	1.52	0.1
BPMC	01/04/16	24.19	02/17/16	18.18	-4.78
BPMX	12/30/15	1.5	03/21/16	1.35	0.03
BPTH	01/12/16	1.36	02/17/16	1.41	0.08

code	start_date	start	stop_date	stop	profit
BUR	01/11/16	1.43	01/27/16	1.43	0.05
BVXV	02/22/16	3.65	02/29/16	3.74	0.18
BXLT	01/14/16	40.64	03/23/16	40.18	-9.28
CALA	01/20/16	4.75	02/16/16	5.35	4.8
CANF	01/19/16	2.15	03/22/16	2.67	1.66
CAPR	12/29/15	2.97	03/17/16	2.7	0.93
CARA	12/28/15	15.31	03/23/16	5.91	10.05
CASI	01/14/16	0.68	03/17/16	1.09	0.42
CATB	01/14/16	6.26	03/03/16	4.45	1.36
CBAY	01/27/16	1.04	03/18/16	1.3	0.82
CBIO	01/26/16	2.24	03/22/16	1.74	-0.1
CBLI	01/06/16	3.68	03/07/16	3.48	-0.16
CBM	01/12/16	40.96	03/23/16	41.5	11.29
CBMG	01/20/16	12.08	03/22/16	16.67	13.38
CBPO	01/19/16	128.56	03/17/16	112.98	138.14
CBYL	01/19/16	2.45	02/16/16	0.54	0.49
CCXI	01/20/16	3.82	03/16/16	2.81	1.66
CDTX	01/25/16	13.67	03/22/16	10.84	4.37
CDXS	01/04/16	4.23	03/11/16	3.84	-0.2
CELG	12/28/15	119.71	03/23/16	100.28	23.87
CELGZ	01/07/16	1.27	02/01/16	1.42	0.16
CEMI	01/21/16	4.3	01/21/16	4.3	0.1
CEMP	12/28/15	31.15	03/24/16	15.09	4.59
CERS	12/28/15	6.53	03/04/16	5.91	9.62
CERU	01/20/16	2.26	03/23/16	2.88	1.16
CFRX	01/13/16	4.39	03/11/16	3.59	-0.8
CGEN	12/28/15	6.56	03/24/16	5.71	3.33
CHMA	01/04/16	19.57	03/08/16	10.18	11.29
CHRS	12/28/15	22.5	03/24/16	19.09	16.66
CLBS	01/19/16	0.61	03/08/16	0.59	0.27
CLCD	02/04/16	5.33	03/03/16	6.26	0.61
CLDN	01/05/16	1.68	02/25/16	0.91	-0.34
CLDX	01/19/16	11	03/23/16	3.69	16.42
CLLS	01/20/16	21.7	03/22/16	27.56	28.59
CLRB	01/14/16	0.44	03/10/16	5.16	0.37
CLSN	01/21/16	1.35	03/23/16	1.45	0.25
CLVS	01/20/16	21.17	03/24/16	18.54	32.59
CMRX	01/11/16	7.9	03/23/16	4.82	8.75
CNAT	01/21/16	1.64	03/23/16	2.11	0.46
CNCE	12/29/15	19.4	03/23/16	13.05	4.67
COLL	12/30/15	26.03	03/23/16	16.71	2.56
CORI	01/20/16	5.15	03/07/16	5.37	0.93
CORT	01/14/16	3.75	03/23/16	4.24	2.86
CPHI	01/19/16	0.15	02/03/16	0.13	0.01
CPIX	01/11/16	5.05	03/23/16	4.54	-0.06
CPRX	12/28/15	2.47	03/24/16	1.17	1.89
CPXX	01/25/16	1.4	03/17/16	8.98	3.93
CRBP	01/22/16	1.51	03/02/16	1.38	0.14
CRIS	01/19/16	1.77	03/22/16	1.57	1
CRMD	12/28/15	2.05	03/24/16	2.38	0.53
CRME	01/25/16	5.31	03/22/16	4.09	0.43
CSBR	03/03/16	4.15	03/03/16	4.15	-0.45
CTIC	01/12/16	1.22	03/17/16	0.56	0.67
CTLT	12/29/15	25.25	02/16/16	22.9	-12.79

Table 4.2 (Continued) Results of Strategy Involved with KDJ in Market of US

code	start_date	start	stop_date	stop	profit
CVM	01/04/16	0.37	03/16/16	0.57	0.03
CXRX	01/25/16	28.35	02/22/16	28.11	31.77
CYAD	01/21/16	33.5	03/22/16	48.3	0.89
CYAN	01/11/16	5.09	01/11/16	5.09	0.16
CYCC	01/20/16	0.33	02/23/16	0.35	0.02
CYNA	01/20/16	13.42	02/17/16	13.57	0.9
CYTK	01/05/16	10.51	03/24/16	6.52	-1.78
CYTR	01/19/16	1.75	03/23/16	2.5	3.51
CYTX	12/28/15	0.19	03/22/16	0.19	-0.03
DBVT	01/25/16	27.2	03/09/16	29.28	10.7
DCTH	01/05/16	0.54	03/10/16	0.32	0.01
DEPO	12/28/15	18.62	03/15/16	14.65	17.56
DERM	01/20/16	25.51	03/23/16	19.82	6.28
DNAI	01/04/16	13.56	03/24/16	6.13	-5.38
DPLO	01/20/16	30.37	03/17/16	25.67	41.13
DPRX	01/19/16	8.65	02/18/16	6.15	3.61
DRNA	01/14/16	7.48	03/24/16	4.71	4.38
DRRX	01/20/16	1.11	02/17/16	1.07	0.6
DSCO	01/14/16	2.66	03/22/16	1.63	0.78
DVAX	01/07/16	25.5	03/22/16	19.19	17
EARS	12/28/15	4.67	03/17/16	3.86	3.59
EBIO	01/19/16	0.61	03/17/16	0.38	0.38
EBS	01/20/16	33.3	03/24/16	33.04	26.1
ECTE	01/14/16	1.33	03/10/16	1.41	-0.08
ECYT	01/19/16	2.87	03/22/16	3.49	1.98
EGLT	01/04/16	10.07	03/23/16	6.87	10.89
EGRX	01/07/16	86.42	02/18/16	63.42	80.86
ENDP	01/19/16	52.41	03/16/16	33.68	-2.78
ENTA	01/20/16	25.88	03/23/16	27.38	31.05
ENZN	12/28/15	0.61	03/04/16	0.46	-0.06
ENZY	01/25/16	8.5	03/16/16	8.39	0.19
EPIX	02/09/16	2.84	02/09/16	2.84	-0.18
EPRS	01/19/16	2.44	03/10/16	3.06	0.39
EPZM	01/20/16	9.44	03/23/16	10.63	5.3
ESPR	12/28/15	22.3	03/24/16	15.24	31.04
EVGN	01/13/16	8.06	02/01/16	6.6	-0.91
EVOK	01/20/16	2.51	02/17/16	3.4	0.45
EXEL	01/20/16	4.06	03/24/16	3.95	-2.23
EYEG	01/26/16	1.7	02/25/16	2.92	1.63
FATE	01/19/16	2.55	03/23/16	1.84	1.07
FBIO	01/13/16	2.71	03/11/16	3.27	-0.92
FCSC	01/14/16	3.12	03/24/16	2.38	0.74
FGEN	12/28/15	30.5	03/24/16	19.11	-1.98
FLKS	12/29/15	11.96	03/15/16	9.66	5.26
FLML	12/28/15	14.5	03/15/16	10.47	5.34
FLXN	01/05/16	18.68	03/24/16	8.76	0.96
FOLD	01/14/16	7.1	03/24/16	7.59	24.61
FOMX	12/28/15	7.86	03/22/16	6.24	6.92
FPRX	01/12/16	36.58	03/23/16	36.56	8.61
FWP	01/19/16	16.7	03/07/16	14.41	-1.37
GALE	01/12/16	0.8	03/24/16	1.11	0.42
GALT	12/28/15	1.78	02/17/16	1.13	-0.54
GBIM	01/14/16	3.11	02/29/16	0.91	0.43
GBT	12/28/15	32.9	03/23/16	15	-3.62

Table 4.2 (Continued) Results of Strategy Involved with KDJ in Market of US

code	start_date	start	stop_date	stop	profit
GLMD	01/19/16	5.69	03/22/16	4.28	3.68
GLPG	01/20/16	51.85	03/04/16	44.17	1.17
GLYC	12/28/15	6.23	03/08/16	6.17	1.91
GNCA	01/14/16	3.48	02/16/16	3.73	2.45
GNVC	12/30/15	1.83	03/17/16	0.73	0.18
GRFS	12/28/15	32.5	03/24/16	15.06	-1.79
GSK	01/14/16	38.38	03/01/16	39.42	28.46
GTXI	12/30/15	0.7	03/03/16	0.64	0.16
GWPH	12/28/15	68.18	03/16/16	71.37	-15.16
HALO	01/20/16	9.37	03/24/16	8.74	0.25
HEB	02/18/16	0.14	03/09/16	0.16	0.06
HRTX	12/28/15	28.21	03/08/16	17.9	51.95
HSGX	01/19/16	2.29	03/02/16	2.81	0.47
HTBX	01/05/16	2.55	03/17/16	1.46	-9.62
HZNP	01/19/16	17.78	03/23/16	15.96	18.94
IBIO	01/14/16	0.53	03/10/16	0.62	0.01
ICCC	12/30/15	7.6	01/06/16	7.6	0.12
ICPT	01/05/16	149.65	03/23/16	123.06	213.37
IDRA	12/29/15	3.03	03/23/16	1.94	-3.33
IDXX	01/20/16	66.95	02/23/16	71.4	19.76
ILMN	01/14/16	161.88	03/24/16	153.54	94.81
IMDZ	01/19/16	11.06	03/22/16	12.78	14.75
IMGN	01/20/16	9.08	03/24/16	7.71	12.74
IMMU	01/20/16	1.82	03/03/16	2.38	1.87
IMMY	12/30/15	7.16	03/11/16	4.1	0.15
IMNP	01/14/16	0.51	03/08/16	0.49	-0.06
IMUC	01/21/16	0.26	02/18/16	0.26	0.01
INCY	01/14/16	76.35	03/23/16	67.94	137.55
INFI	01/20/16	6.03	03/24/16	5.18	5.69
INNL	12/31/15	8.35	02/24/16	9	-0.21
INO	01/20/16	4.66	03/23/16	7.74	8.83
INSM	01/20/16	13.44	03/23/16	11.93	19.89
INSY	12/29/15	28.88	03/24/16	17.04	8.62
IONS	01/25/16	47.08	03/24/16	40.74	56.45
IPCI	01/07/16	2.01	03/17/16	2.11	0.51
IPXL	01/14/16	36.05	02/22/16	32.23	0.75
IRWD	01/20/16	9.33	02/12/16	8.13	2.69
ITCI	01/19/16	44.5	03/24/16	24.97	0.11
ITEK	01/04/16	11.13	03/15/16	7.23	2.43
JAGX	01/07/16	2.35	02/22/16	1.87	1.49
JAZZ	01/14/16	125.81	02/22/16	125.05	121.68
JNJ	12/28/15	102.31	02/19/16	104.18	20.64
JNP	12/28/15	10.05	03/01/16	7.9	0.8
JUNO	12/29/15	43.67	03/24/16	36.32	-85.14
KERX	01/20/16	3.12	03/24/16	4.53	3.23
KIN	12/28/15	3.74	03/23/16	3.54	0.97
KITE	12/28/15	61.43	03/04/16	55.31	134.81
KMDA	01/13/16	4.27	02/24/16	3.68	0.1
KMPH	01/19/16	15.33	03/23/16	14.78	3.97
KPTI	01/05/16	13.23	03/24/16	8.38	-0.37
LBIO	01/19/16	5.67	03/24/16	4.52	0.49
LCI	01/19/16	34.19	03/24/16	17.56	14.96
LGND	01/13/16	97.47	03/24/16	100.9	61.45
LIFE	01/25/16	6.01	03/23/16	5.08	-2.74

Table 4.2 (Continued) Results of Strategy Involved with KDJ in Market of US

code	start_date	start	stop_date	stop	profit
LOXO	01/14/16	21.16	03/21/16	22.18	15.5
LPCN	01/25/16	9.71	03/23/16	10.61	0.25
LPTN	01/26/16	0.17	03/17/16	0.22	2.22E-16
LXRX	01/20/16	9.64	02/17/16	9.85	9.46
MACK	12/28/15	8.18	03/02/16	6.63	-1.15
MCRB	01/12/16	30.12	03/23/16	24.54	43.2
MCUR	12/30/15	1.26	03/22/16	0.98	0.33
MDCO	12/29/15	37.11	03/23/16	31.82	40.65
MDGN	01/21/16	3.98	03/24/16	4.33	0.23
MDVN	01/20/16	36.16	03/23/16	38.03	50.48
MDWD	12/29/15	9	03/15/16	7.77	0.62
MEIP	01/20/16	1.23	03/11/16	1.21	0.53
MGNX	01/20/16	21.26	03/23/16	16.3	29.21
MNK	01/14/16	65.55	03/23/16	60.78	-21.81
MNKD	01/13/16	0.8	03/16/16	1.49	1.77
MNOV	01/26/16	3.96	02/23/16	5.59	1.67
MNTA	01/11/16	13.85	03/22/16	9.23	10.49
MRK	12/28/15	52.3	03/23/16	53.15	13.41
MRNS	01/19/16	5.78	03/23/16	5.05	2.67
MRTX	01/12/16	25.47	03/24/16	19.6	29.63
MSLI	01/21/16	1.22	03/22/16	1.41	0.03
MSTX	01/25/16	0.43	03/23/16	0.25	-0.43
MYL	01/19/16	50.32	03/11/16	48.12	30.11
MYOS	02/16/16	1.54	03/21/16	1.63	0.14
NAII	02/10/16	8.89	03/17/16	11.85	2.87
NATR	01/14/16	8.91	02/16/16	7.41	0.87
NAVB	01/12/16	1.11	03/21/16	0.99	-0.04
NBIX	12/28/15	53.06	03/21/16	36.76	88.24
NBY	01/07/16	2.33	03/22/16	2.35	0.02
NDRM	12/28/15	16.4	03/16/16	13	0.24
NEOG	01/19/16	51.51	03/24/16	44.02	-52.04
NEOS	01/25/16	9.78	03/23/16	10.77	-6.65
NEOT	12/29/15	1.54	03/16/16	0.75	0.14
NEPT	01/11/16	1.13	02/24/16	1.03	0.21
NERV	01/25/16	5.42	03/07/16	5.3	0.4
NK	12/28/15	16.6	03/23/16	8.56	20.42
NKTR	01/19/16	14.05	02/29/16	11.31	7.78
NLNK	01/20/16	26.39	03/22/16	18.99	30.56

From Table 4.2, 80% of the stocks are profitable. Even though 147 share prices decline, they are still profitable. Here is no doubt that our strategy is better than buy-and-hold (passive) strategy. To optimize the strategy or improve the accuracy of the investment, we can select the share before trading, which may make us more profitable and reduce the risk. A large body of evidence has accumulated suggesting that stock returns are predictable by means of publicly available information on a number of

financial and macroeconomic variables with an important business cycle component [6]. Here we didn't select the share, but traded with total 300 shares. The furthermore study is to select the stock second fundamental analysis, policy regulation, and message of rumors.

In addition, there are 20% deficit stocks, which may be caused by several situations. First, the share prices kept on declining in three month and with little fluctuation of share prices. At this situation, we definitely would loss money. As I described above, we can avoid buying these shares by fundamental analysis. Second, there is a certain probability the golden-cross is false or not accurate, which may mislead us to buy the shares. After buying the shares second the false golden-cross, the price will not increase, but drop, which means we lose money.

APPENDIX A

B-SHARE MARKET

We also performed our strategy on B-share market in China. From Table 4.3, we find 37 stocks are profitable. Even though share prices dropped, 12 stocks are still profitable.

Table A.1 Results of Strategy Involved with KDJ in Market of China

CODE	START DATE	START	STOP DATE	STOP	PROFIT
900947	2015-10-29	0.521	2016-02-02	0.492	0.02
900946	2015-10-29	0.535	2016-02-02	0.497	0.496
900952	2015-10-29	0.574	2016-02-02	0.54	1.129
900937	2015-10-29	0.577	2016-02-02	0.492	-0.522
900938	2015-10-29	0.6	2016-02-02	0.537	1.574
900921	2015-10-29	0.613	2016-02-02	0.566	-0.198
900907	2015-10-29	0.617	2016-02-02	0.669	2.002
900918	2015-10-29	0.62	2016-02-02	0.65	0.384
900919	2015-10-29	0.627	2016-02-02	0.654	3.471
900945	2015-10-29	0.634	2016-02-02	0.662	0.491
900933	2015-10-29	0.655	2016-02-02	0.664	1.044
900910	2015-10-29	0.694	2016-02-02	0.842	3.244
900906	2015-11-24	0.702	2016-02-02	0.654	-2.541
900908	2015-10-29	0.708	2016-02-02	0.763	2.678
900901	2015-10-29	0.709	2016-02-02	0.746	2.758
900941	2015-10-29	0.727	2016-02-02	0.728	1.925
900917	2015-10-29	0.741	2016-02-02	0.706	-0.206
900955	2015-12-02	0.753	2016-02-02	0.612	-0.047
900920	2015-10-29	0.76	2016-02-02	0.803	2.616
900948	2015-10-29	0.823	2016-02-02	0.746	-0.518
900957	2015-10-29	0.823	2016-02-02	1.143	1.579
900916	2015-10-29	0.835	2016-02-02	0.868	5.716
900936	2015-10-29	0.86	2016-02-02	0.839	1.052
900940	2015-10-29	0.9	2016-02-02	0.744	0.475
900951	2015-10-29	0.925	2016-02-02	1.272	5.187
900953	2015-10-29	0.949	2016-02-02	1.114	5.018
900927	2015-12-25	0.967	2016-02-02	0.909	-0.767
900909	2015-10-29	0.98	2016-02-02	1.144	6.099
900902	2015-10-29	1.018	2016-02-02	1.222	7.077
900924	2015-10-29	1.042	2016-02-02	1.06	4.619
900922	2015-11-04	1.05	2016-02-02	1.667	5.101
900943	2015-10-29	1.063	2016-02-02	1.196	2.514
900903	2015-10-29	1.067	2016-02-02	1.115	2.747

Table A.1 (Continued) Results of Strategy Invovled with KDJ in Market of China

CODE	START DATE	START	STOP DATE	STOP	PROFIT
900928	2015-10-29	1.453	2016-02-02	1.376	5.514
900930	2015-10-29	1.469	2016-02-02	1.672	1.514
900911	2015-10-29	1.675	2016-02-02	1.538	1.702
900942	2015-10-29	1.675	2016-02-02	1.801	4.617
900914	2015-10-29	1.837	2016-02-02	1.844	0.504
900904	2015-10-29	1.843	2016-02-02	1.706	6.703
900923	2015-10-29	1.907	2016-02-02	1.62	4.345
900935	2015-10-29	2.013	2016-02-02	2.471	-9.193
900912	2015-10-29	2.161	2016-02-02	1.821	1.225
900925	2015-10-29	2.481	2016-02-02	2.468	-5.192
900915	2015-10-29	2.773	2016-02-02	2.608	-4.2
900939	2015-10-29	1.223	2016-02-02	1.505	4.737

APPENDIX B

CODE FOR TRADING

B.1 Code for Getting The Daily Data

In this APPENDIX, we use the code in Table B.1 to get the daily data.

Table B.1 Code for Getting The Daily Data

```python
import tushare as ts

import sys

reload(sys)

sys.setdefaultencoding('utf8')

error = open('error.txt', 'w')

stock_code = open("stock_code.txt","r")

sc = stock_code.read()

stock_code.close()

sc = sc.split('\n')

for i in sc:

    try:

        df = ts.get_stock_basics()

        start_date = df.ix[i]['timeToMarket']

        start_date = str(start_date)

sd=start_date[:4] + '-' + start_date[4:6] + '-' +start_date[6:8]

        stock = ts.get_h_data(i, start=sd, end='2015-12-18')

        name_of_file = '%s.xlsx'%i

        stock.to_excel(name_of_file)

except Exception, e:
```

```
print "error%s"%i

    error.write(str(i)+'\n')

error.close()
```

B.2 Code for Getting Transaction Detail

In this APPENDIX, we use the code in Table B.2 to get transaction detail.

Table B.2 Code for Getting Transaction Detail

```python
import tushare as ts

import sys

reload(sys)

sys.setdefaultencoding('utf8')

error = open('error.txt', 'w')

stock_code = open("stock_code.txt","r")

sc = stock_code.read()

stock_code.close()

sc = sc.split('\n')

for i in sc:

    try:

        df = ts.get_stock_basics()

        start_date = df.ix[i]['timeToMarket']

        start_date = str(start_date)

        print i

        sd=start_date[:4] + '-' + start_date[4:6] + '-' +start_date[6:8]

        stock = ts.get_tick_data (i, start=sd, end='2015-12-18')

        name_of_file = '%s.xlsx'%i

        stock.to_excel(name_of_file)

    except Exception, e:

        print "error%s"%i

        error.write(str(i)+'\n')

error.close()
```

B.3 Code for Daily KDJ

In this APPENDIX, we use the code in Table B.3 to calculate daily KDJ.

Table B.3 Code for Daily KDJ

```
setwd("/Users/apple/Workspace/day_price")

library(ggplot2)

library(reshape2)

library(dplyr)

day <-read.table("SZ300357.txt",header =T,skip=1,stringsAsFactors = F,

         col.names=c("date","open","high","low","price","vol","value"),fill=T)

day <- day[-(nrow(day)),]

day$h_d <- NA

day$l_d <- NA

for(i in 9:nrow(day)){

  day$h_d[i] <- max(day$high[(i-8):i])

  day$l_d[i] <- min(day$low[(i-8):i])


}

day <- na.omit(day)

day$rsv_d <- NA

day$k_d<- NA

day$d_d<- NA

day$j_d <-NA

day$rsv_d[1] <- (day$price[1] -day$l_d[1])/(day$h_d[1] -day$l_d[1])*100

day$k_d[1] <- 2/3 *50 + 1/3 *day$rsv_d[1]
```

Table B.3 (continued) Code for Daily KDJ

```
day$d_d[1] <- 2/3 *50 + 1/3 *day$k_d[1]

day$j_d[1] <-3*day$k_d[1] -2*day$d_d[1]

for(i in 2:dim(day)[1]) {

  day$rsv_d[i] <- (day$price[i] -day$l_d[i])/(day$h_d[i] -day$l_d[i])*100

  if (is.na(day$rsv_d[i])){

    day$k_d[i] <- day$k_d[i-1]

    day$d_d[i] <- day$d_d[i-1]

    day$j_d[i] <- day$j_d[i-1]

  }

  else{

    day$k_d[i] <- 2/3 *day$k_d[i-1]+1/3 *day$rsv_d[i]

    day$d_d[i] <- 2/3 *day$d_d[i-1]+1/3 *day$k_d[i]

    day$j_d[i] <-3*day$k_d[i] -2*day$d_d[i]

  }

}

day <- select(day,date,k_d,d_d,j_d)

day$date <- as.Date(day$date)

day <- melt(day,id=("date"))

ggplot(data=day,aes(x=date, y=value, colour=variable)) + geom_line()
```

B.4 Code for Every Minute's KDJ

In this APPENDIX, we use the code in Table B.4 to calculate every minute's KDJ.

Table B.4 Code for Every Minute's KDJ

```
library(ggplot2)

library(ggplot2)

library(reshape2)

library(dplyr)

setwd("/Users/apple/Workspace/stock")

kdj<-read.table("SZ300357.txt",header =T,skip=1,stringsAsFactors = F,

col.names=c("date","time","open","high","low","price","vol","value"),fill=T)

kdj<-kdj[-nrow(kdj),]

kdj$hour <- NA

kdj$minute <- NA

for(i in 1 : dim(kdj)[1]){

        if(substr(kdj$time[i],1,1) =="9"){

        kdj$hour[i] <- 9

        kdj$minute[i] <-substr(kdj$time[i],2,3)

        }

  else {

        kdj$hour[i] <- substr(kdj$time[i],1,2)

        kdj$minute[i] <- substr(kdj$time[i],3,4)

        }

}

kdj$time <- paste(kdj$hour,kdj$minute,sep=":")
```

```
kdj$time <- paste(kdj$date,kdj$time,sep =" ")

kdj$time <- as.POSIXct(kdj$time , format = "%Y/%m/%d %H:%M" )

kdj$h <- NA

kdj$l <- NA

for(i in 9:nrow(kdj)){

        kdj$h[i] <- max(kdj$high[(i-8):i])

        kdj$l[i] <- min(kdj$low[(i-8):i])

  }

kdj <- na.omit(kdj)

rownames(kdj) <- rep(1:dim(kdj)[1])

kdj$rsv <- NA

kdj$k<- NA

kdj$d<- NA

kdj$j <-NA

while((kdj$h[1] ==kdj$l[1])){

        kdj <-kdj[-1,]

}

kdj$rsv[1] <- (kdj$price[1] -kdj$l[1])/(kdj$h[1] -kdj$l[1])*100

kdj$k[1] <- 2/3 *50 + 1/3 *kdj$rsv[1]

kdj$d[1] <- 2/3 *50 + 1/3 *kdj$k[1]

kdj$j[1] <-3*kdj$k[1] -2*kdj$d[1]

for(i in 2:dim(kdj)[1]) {

        kdj$rsv[i] <- (kdj$price[i] -kdj$l[i])/(kdj$h[i] -kdj$l[i])*100
```

```
if (is.na(kdj$rsv[i])){

              kdj$k[i] <- kdj$k[i-1]

              kdj$d[i] <- kdj$d[i-1]

              kdj$j[i] <- kdj$j[i-1]

              }

       else{

              kdj$k[i] <- 2/3 *kdj$k[i-1]+1/3 *kdj$rsv[i]

              kdj$d[i] <- 2/3 *kdj$d[i-1]+1/3 *kdj$k[i]

              kdj$j[i] <-3*kdj$k[i] -2*kdj$d[i]

              }

}

kdj <- kdj[11033:11151,]

kdj <- select(kdj,time,k,d,j)

kdj <- melt(kdj,id=("time"))

ggplot(data=kdj,aes(x=time, y=value, colour=variable)) + geom_line()
```

B.5 Code for Ma5 and Ma10

In this APPENDIX, we use the code in Table B.5 to calculate Ma5 and Ma10.

Table B.5 Code for Ma5 and Ma10

```
setwd("/Users/apple/Workspace/day_price")

library(ggplot2)

library(reshape2)

library(dplyr)

day <-read.table(file ="SZ300357.txt",header =T,skip=1,stringsAsFactors = F,

        col.names=c("date","open","high","low","price","vol","value"),fill=T)

day <- day[-(nrow(day)),]

day$ma5 <-NA

day$ma10 <-NA

for(i in 5: nrow(day)){

        day$ma5[i] <- sum(day$price[(i-4):i] ) / 5

}

for(i in 10: nrow(day)){

        day$ma10[i] <- sum(day$price[(i-9):i] )/10

}

day <- na.omit(day)

day$date <- as.Date(day$date)

day <- select(day,date,price,ma5,ma10)

day <- melt(day,id=("date"))

ggplot(data=day,aes(x=date, y=value, colour=variable)) +geom_line()
```

B.6 Code for Trading Simulation

In this APPENDIX, we use the code in Table B.6 for trading simulation.

Table B.6 Code for Trading Simulation

```
library(dplyr)

setwd("/Users/apple/Workspace/result")

summ <- read.table("summary.txt",header =T, sep =" ")

#summ <- data.frame(code=
as.character(),start_date=as.character(),start=as.numeric(),stop_date=as.character(),stop=
as.numeric(),profit=as.numeric())

setwd("/Users/apple/Workspace/export")

filenames <- list.files( path="/Users/apple/Workspace/export",pattern="*.txt",
full.names=F)

setwd("/Users/apple/Workspace/AsD")

filenames2 <- list.files( path="/Users/apple/Workspace/AsD",pattern="*.txt",
full.names=F)

filenames <- filenames[filenames%in%filenames2]

for( p in 1:length(filenames)){

 setwd("/Users/apple/Workspace/export")

 kdj<-read.table(file =filenames[p],header =T,skip=1,stringsAsFactors =
F,col.names=c("date","time","open","high","low","price","vol","value"),fill=T)

kdj<-kdj[-nrow(kdj),]

kdj$hour <- NA

kdj$minute <- NA

for(i in 1 : dim(kdj)[1]){

        if(substr(kdj$time[i],1,1) =="9"){

                kdj$hour[i] <- 9

                kdj$minute[i] <-substr(kdj$time[i],2,3)
```

```
        }

        else{

kdj$hour[i] <- substr(kdj$time[i],1,2)

        kdj$minute[i] <- substr(kdj$time[i],3,4)

        }

 }

kdj$time <- paste(kdj$hour,kdj$minute,sep=":")

kdj$time <- paste(kdj$date,kdj$time,sep =" ")

kdj$time <- as.POSIXct(kdj$time , format = "%Y/%m/%d %H:%M" )

kdj$date <- NULL

kdj$hour <- NULL

kdj$minute <- NULL

kdj$open <-NULL

kdj$h <- NA

kdj$l <- NA

for(i in 9:nrow(kdj)){

        kdj$h[i] <- max(kdj$high[(i-8):i])

        kdj$l[i] <- min(kdj$low[(i-8):i])


}

kdj <- na.omit(kdj)

rownames(kdj) <- rep(1:dim(kdj)[1])

kdj$rsv <- NA

kdj$k<- NA

kdj$d<- NA
```

```
kdj$j <-NA

while((kdj$h[1] ==kdj$l[1])){

        kdj <-kdj[-1,]

 }


kdj$rsv[1] <- (kdj$price[1] -kdj$l[1])/(kdj$h[1] -kdj$l[1])*100

kdj$k[1] <- 2/3 *50 + 1/3 *kdj$rsv[1]

kdj$d[1] <- 2/3 *50 + 1/3 *kdj$k[1]

kdj$j[1] <-3*kdj$k[1] -2*kdj$d[1]

for(i in 2:dim(kdj)[1]) {

        kdj$rsv[i] <- (kdj$price[i] -kdj$l[i])/(kdj$h[i] -kdj$l[i])*100

        if (is.na(kdj$rsv[i])){

                kdj$k[i] <- kdj$k[i-1]

                kdj$d[i] <- kdj$d[i-1]

                kdj$j[i] <- kdj$j[i-1]

        }

        else{

                kdj$k[i] <- 2/3 *kdj$k[i-1]+1/3 *kdj$rsv[i]

                kdj$d[i] <- 2/3 *kdj$d[i-1]+1/3 *kdj$k[i]

                kdj$j[i] <-3*kdj$k[i] -2*kdj$d[i]

                }

 }

kdj$action <-NA

for(i in 2:(dim(kdj)[1]-1)) {

        if(kdj$d[i-1]>kdj$k[i-1] & kdj$k[i-1]>kdj$j[i-1] &
```

```
                    kdj$d[i]<kdj$k[i] & kdj$k[i]<kdj$j[i]&kdj$d[i-1]<30)

  {

                    kdj$action[i+1] <- "buy"

  }



                    if(kdj$d[i-1]<kdj$k[i-1] & kdj$k[i-1]<kdj$j[i-1] &

                    kdj$d[i]>kdj$k[i] & kdj$k[i]>kdj$j[i]&kdj$j[i-1] >70)

{

                        kdj$action[i+1] <- "sell"

                    }



  }


  kdj$date <- as.Date(kdj$time)

  kdj$date <- as.character(kdj$date)

  kdj <- select(kdj,time,date,price,action)

  kdj$action[is.na(kdj$action)] <- 0


  setwd("/Users/apple/Workspace/AsD")

  day <-read.table(file =filenames[p],header =T,skip=1,stringsAsFactors = F,

            col.names=c("date","open","high","low","price","vol","value"),fill=T)

  day <- day[-(nrow(day)),]

  day$ma2 <-NA

  day$ma5 <-NA

day$ma10 <-NA
```

```
for(i in 2: (nrow(day)-1)){

        day$ma2[i+1] <- sum(day$price[(i-1):i])/2

 }

for(i in 5: (nrow(day)-1)){

        day$ma5[i+1] <- sum(day$price[(i-4):i] ) / 5

 }

for(i in 10: (nrow(day)-1)){

        day$ma10[i+1] <- sum(day$price[(i-9):i] )/10

 }

day$h_d <- NA

day$l_d <- NA

for(i in 9:nrow(day)){

        day$h_d[i] <- max(day$high[(i-8):i])

        day$l_d[i] <- min(day$low[(i-8):i])

}

day <- na.omit(day)

day$rsv_d <- NA

day$k_d<- NA

day$d_d<- NA

day$j_d <-NA

day$rsv_d[1] <- (day$price[1] -day$l_d[1])/(day$h_d[1] -day$l_d[1])*100

day$k_d[1] <- 2/3 *50 + 1/3 *day$rsv_d[1]

day$d_d[1] <- 2/3 *50 + 1/3 *day$k_d[1]

day$j_d[1] <-3*day$k_d[1] -2*day$d_d[1]

for(i in 2:dim(day)[1]) {
```

```
day$rsv_d[i] <- (day$price[i] -day$l_d[i])/(day$h_d[i] -day$l_d[i])*100

    if (is.na(day$rsv_d[i])){

        day$k_d[i] <- day$k_d[i-1]

        day$d_d[i] <- day$d_d[i-1]

        day$j_d[i] <- day$j_d[i-1]

    }

    else{

        day$k_d[i] <- 2/3 *day$k_d[i-1]+1/3 *day$rsv_d[i]

        day$d_d[i] <- 2/3 *day$d_d[i-1]+1/3 *day$k_d[i]

        day$j_d[i] <-3*day$k_d[i] -2*day$d_d[i]

    }

}

day$action_d <-NA

for(i in 2:(dim(day)[1]-1)) {

    if(day$d_d[i-1]>day$k_d[i-1] & day$k_d[i-1]>day$j_d[i-1] &

        day$d_d[i]<day$k_d[i] & day$k_d[i]<day$j_d[i]&day$d_d[i-1]<60){

day$action_d[i+1] <- "buy"

    }

    if(day$d_d[i-1]<day$k_d[i-1] & day$k_d[i-1]<day$j_d[i-1] &

        day$d_d[i]>day$k_d[i] & day$k_d[i]>day$j_d[i]&day$j_d[i-1] >70)

{

    day$action_d[i+1] <- "sell"

}

}

day$action_d[is.na(day$action_d)] <- 0
```

```r
day <- day[order(day$date,decreasing = T),]

  for(i in 3:nrow(day)){

        if(day$action_d[i] =="buy"){

                day$action_d[i-1] <-"buy"

                day$action_d[i-2] <-"buy"

        }

  }

  day <- day[order(day$date,decreasing = F),]

  day<- select(day,date,ma2,ma5,ma10,action_d)

  day$date <- as.POSIXct(day$date , format = "%Y/%m/%d")

  day$date <- as.character(day$date)

  kdj <- merge(kdj,day,by.x="date",by.y="date")

  kdj1 <- kdj

  kdj <- arrange(kdj,time)

  kdj$day1 <- NA

j <- 1

  for( i in 1:(nrow(kdj)-1)){

        if(kdj$date[i]==kdj$date[i+1]){

                kdj$day1[i] <-j

}

        else{

                kdj$day1[i] <-j

                j <- j+1

        }

  }
```

```
kdj$day1[nrow(kdj)] <-j

kdj$buy_date <- NA

kdj$buy_price <- NA

kdj$sell_price <- NA

kdj$sell_date <- NA

kdj$lose_date <-NA

kdj$lose_price <- NA

kdj$time <- as.character(kdj$time)

tempp2 <-c()

maxclose <-0.1

tempp <-0.1

for(i in 2:nrow(kdj)) {

        second <-substr(kdj$time[i],(nchar(kdj$time[i])-7),nchar(kdj$time[i]))

        if(second=="15:00:00"){

                tempp <- kdj$price[i]

                tempp2 <- c(tempp2,tempp)

                maxclose <- max(tempp2)

}


        if(kdj$action_d[i]=="buy"){

                if(kdj$action[i]== "buy"){

                        kdj$buy_date[i] <-  kdj$time[i]

                        kdj$buy_price[i]<- kdj$price[i]

                        b <-kdj[i:nrow(kdj),]

    a <- subset(b,b$day1 ==b$day1[1]|b$day1 ==b$day1[1] +1|b$day1 ==b$day1[1] +2)
```

```
for(n in 1:nrow(a)){

        if(a$price[n]>a$price[1] *1.02){

                kdj$sell_date[i] <-a$time[n]

                kdj$sell_price[i]<- a$price[n]

                break

        }

         if(a$day1[n]==a$day1[1]+1 & a$action_d[n]!="buy"){

                kdj$lose_date[i] <- a$time[n]

                kdj$lose_price[i] <-a$price[n]

                break

        }

        if(a$day1[n]==a$day1[1]+2 & a$action_d[n] !="buy"){

                kdj$lose_date[i] <- a$time[n]

                kdj$lose_price[i] <-a$price[n]

                break

        }

        else {

                if(n == nrow(a) & is.na(a$sell_date[i])){

                kdj$lose_date[i] <- a$time[nrow(a)]

                kdj$lose_price[i] <-a$price[nrow(a)]

        }

    }

}

}

}
```

```
}

kdj <- kdj[complete.cases(kdj$buy_date),]

for(i in 1:nrow(kdj)){

        if(is.na(kdj$sell_price[i])){

                kdj$win[i] <- kdj$lose_price[i] -kdj$buy_price[i]

        }

         if (is.na(kdj$lose_price[i])){

                kdj$win[i] <-kdj$sell_price[i] - kdj$buy_price[i]

        }

}

kdj <-
select(kdj,buy_date,buy_price,sell_date,sell_price,lose_date,lose_price,win,ma5,ma10,act

ion_d)

sum(kdj$sell_price,na.rm =T)+sum(kdj$lose_price,na.rm =T)-sum(kdj$buy_price,na.rm
=T)

kdj$profit <- NA

kdj$profit[1] <-sum(kdj$sell_price,na.rm =T)+sum(kdj$lose_price,na.rm =T)-

sum(kdj$buy_price,na.rm =T)

kdj[is.na(kdj)] <-""

new <- data.frame(code=
filenames[p],start_date=kdj$buy_date[1],start=kdj$buy_price[1],stop_date=kdj$buy_date
[nrow(kdj)],stop=kdj$buy_price[nrow(kdj)],profit=kdj$profit[1])

summ <- rbind(summ,new)

setwd("/Users/apple/Workspace/result")

write.table(summ,"summary.txt",sep =" ")

write.csv(kdj,paste(filenames[p],"csv",sep="."))}
```

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