Kyiv School of Economics

July 3, 2013

Admission Exam in Mathematics for MA Program in Business Economics

Version A

General Instructions:

- You should NOT open the exam before the exam assistant says so.

- The exam has **30** problems and **10** pages. You have **75** minutes for this exam.

- In all problems, the **Answer** is a single number or a simple expression.

- You should write your answers on a separate **Answer Sheet**.

- You may use back of any page for your draft notes. Additional paper may be provided on your request. However, only the Answer Sheet will be graded. No partial credit will be given for wrong answers.

- Each assignment requires no more than simple High School Math and Logic. Read each assignment carefully and do not do more than it is explicitly required.

- Exam assistants are allowed to provide translation of unknown English terms into Ukrainian or Russian. Other than that, "understanding a question is a part of the question."

- Please, write accurately. I will not be able to grade your work if I fail to read your writing.

- **Cheating on any exam automatically invalidates all your admission tests!**

- GOOD LUCK!!!

Answer Sheet

1. _____   16. _____

2. _____   17. _____

3. _____   18. _____

4. _____   19. _____

5. _____   20. _____

6. _____   21. _____

7. _____   22. _____

8. _____   23. _____

9. _____   24. _____

10. _____   25. _____

11. _____   26. _____

12. _____   27. _____

13. _____   28. _____

14. _____   29. _____

15. _____   30. _____

1. The original price of an item at a store is 40 percent more than the price the retailer paid for it (which is the cost to the retailer). To encourage sales, the retailer reduces the price of the item by 15 percent from the original selling price. If the retailer sells the item at the reduced cost, his profit is what percent of his cost?

2. How many different subsets of the set $10, 14, 17, 24$ contain an even number of elements?

3. A certain series is based on the principles $s_1 = 2$, $s_2 = 1$, $s_3 = 2$, and for all $t \geq 4$, $s_t = s_{t-1} + 2s_{t-2}$. What is s_6?

4. The cost of manufacturing x microwaves is $6,000 + 300\,x$ UAH. The amount received when selling these x microwaves is $700\,x$ UAH. What is the least number of microwaves that must be manufactured and sold that the net profit is 2,400 UAH?

5. To meet a government requirement, a water producing company must test 10 percent of its spring (still) water and 5 percent of its sparkling (carbonated) water for purity before each shipment. If a customer ordered 140 bottles of spring water and 60 bottles of sparkling water, what percent of all bottles must the producer test before it can send the water out?

6. What is the value of a if $3^{3a+4} = 9^a$?

7. What is the smallest value of x for which $\left(\dfrac{8}{x} + 48\right)(2 - x^2) = 0$?

8. Peter takes 8 hours to copy a 50-page manuscript, while Sophia can copy the same manuscript in 6 hours. How many hours would it take them to copy a 100-page manuscript, if they worked together?

9. A recipe for a soda drink requires w liters of water for every liter of syrup. If soda is made according to the recipe using m liters of syrup and sold for j UAH a liter, what will be the gross profit of the supplier if syrup costs k UAH a liter and water costs nothing?

10. If $2x - 4y = -2$ and $3x - 2y = 3$, than what is $2y + x$?

11. How many different ways can 2 students be seated in a row of 4 desks so that there is always at least one empty desk between the students?

12. For the equation $x^2 - 2x - m = 4$, where m is a constant, 4 is one solution for x. What is the other solution?

13. Tamara spends 30 percent of her income on rent and 20 percent of the remainder on food. What percent of her income does she spend on food?

14. A clothing supplier stores 800 coats in a warehouse, of which 20 percent are full-length coats. If 300 of the shorter-length coats are removed from the warehouse, what percent of the remaining coats are full length?

15. A company paid $600,000 in bonuses to employees whose annual performances were rated A, B, or C. Each employee rated A received twice the amount of the bonus that was paid to each employee rated C; each employee rated B received one-and-a-half times the amount of the bonus that was paid to each employee rated C. If 50 workers were rated A, 100 were rated B, and 150 were rated C, how much was the bonus paid to each employee rated A?

16. Company C sells a line of 25 products with an average retail price of $1,200. If none of these products sells for less than $420 and exactly 10 of the products sell for less than $1,000, what is the greatest possible selling price of the most expensive product?

17. The average (arithmetic mean) of $3a + 8$ and another number is $2a$. What is the average of that other number and a?

18. In a certain laboratory, chemicals are identified by a color-coding system. There are 20 different chemicals. Each is coded with either a single color or a unique two-color combination. If the order of colors in the pairs does not matter (i.e. "red-green" and "green-red" combinations are used for the same chemical), what is the minimum number of colors needed to code all 20 chemicals with either a single color or a unique pair of colors?

19. If a sequence of consecutive integers of increasing value has s sum of 63 and a first term is 6, how many integers are in the sequence?

20. In a certain game, each player scores either 2 points or 5 points. If m players score 2 points and n players score 5 points, and the total number of points scored is 50, what is the least positive difference between n and m?

21. Four different prime numbers, each less than 15, are multiplied together. What is the greatest possible result?

22. If $x + y = 2$ and $x^2 - xy - 10 - 2y^2 = 0$, what does $x - 2y$ equal?

23. If $b - a = \dfrac{a^2 - b^2}{b^2 - a^2}$ and $b^2 - a^2 \neq 0$, find $a - b$.

24. If the product of the integers a, b, c, and d is 210, and if $1 < a < b < c < d$, what is the value of $a + b$?

25. 15 balls are placed in a box; some are red, and some are blue. If the number of ref balls is 1 less than the number of blue balls, what is the probability that a ball taken from the box is blue?

26. In a team of 5 students, one of the students can be assigned a "Captain" role, and another student can be assigned a "Second Mate" role. In how many ways could these two roles be assigned?

27. For all real numbers x and y, if $x\#y = x(x - y)$, then what is $7\#(7\#5)$?

For the next **three** questions, use **Figure 1** (next page). The figure shows the distribution of market shares between various diets in the USA in 1995 and 2000.

28. In 1995, approximately how many million people were on the Zone Diet?

29. What is the approximate ratio of the number of people on the Atkins diet in 1995 to the number of people on the Suzanne Somers diet in 2000?

30. Approximately what is the percent change in the number of Mediterranean dieters from 1995 to 2000?
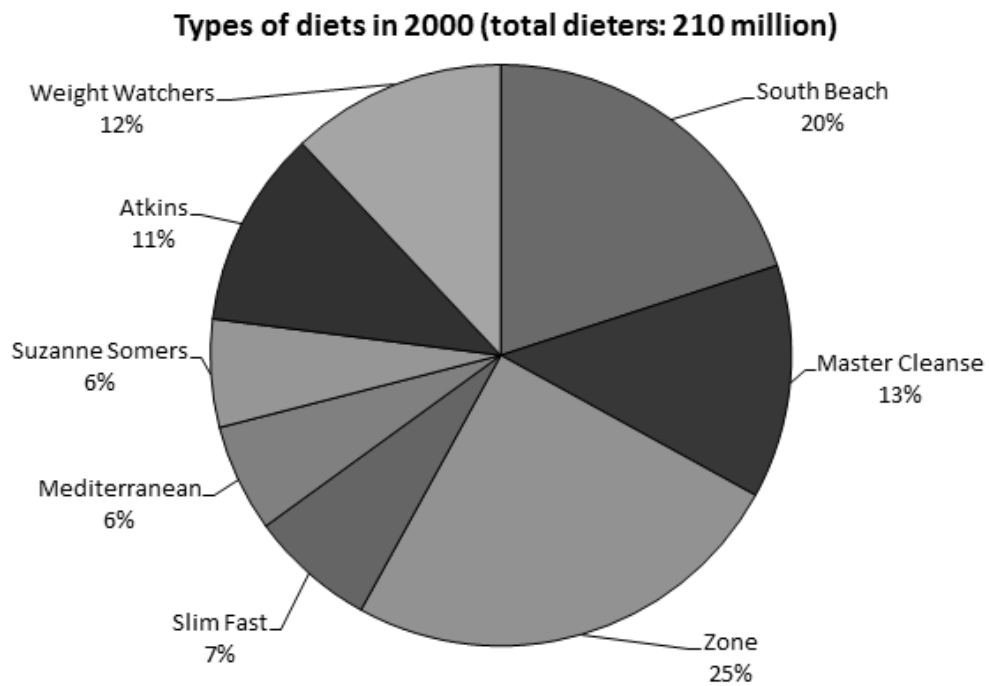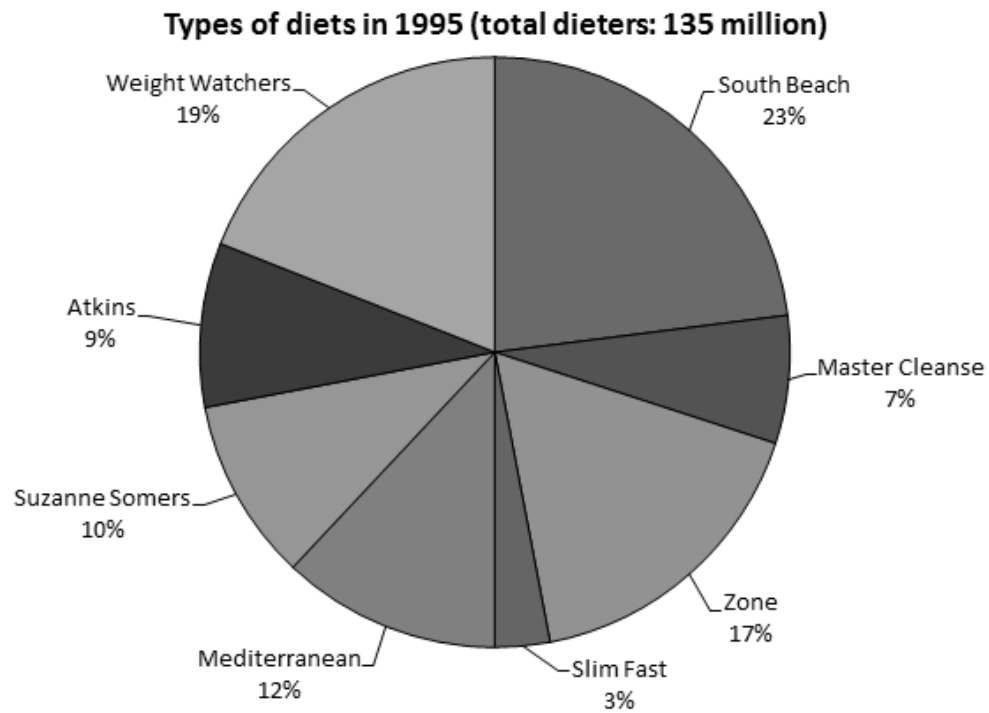
Types of diets in 1995 (total dieters: 135 million)

Weight Watchers
19%

South Beach
23%

Atkins
9%

Master Cleanse
7%

Suzanne Somers
10%

Zone
17%

Mediterranean
12%

Slim Fast
3%

Types of diets in 2000 (total dieters: 210 million)

Weight Watchers
12%

South Beach
20%

Atkins
11%

Master Cleanse
13%

Suzanne Somers
6%

Mediterranean
6%

Slim Fast
7%

Zone
25%

Figure 1: Distribution of Diets Market Shares, 1995 and 2000

Draft Paper, Extra Sheet 1

Draft Paper, Extra Sheet 2