Math Field Day 2011

Mad Hatter 6-8

CSU Fresno `http://www.csufresno.edu/math`

16 April 2011

Mad Hatter 6-8

The Mad Hatter Marathon is a competition in rapid computation and problem solving. You will find that you do not have time to solve every problem. After a few minutes you may feel “mentally out of breath.” Do not let this discourage you. Your fellow contestants feel the same way. That is why this contest is called *Mad Hatter Marathon!*

Mad Hatter 6-8

The Mad Hatter Marathon is divided into two problem solving periods, each lasting 45 minutes. Between the two periods there will be a 15 minute break.

Part I

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Rules and Scoring

You may use pencil and scratch paper to do calculations, but **calculators are not allowed.**

Your score is the total number of correct answers, so give the best answer that you can in the time available for each problem. There is no penalty for guessing.

Ready... Set... Go!

Prepare to begin the *Mad Hatter Marathon!*

Part I - Problem 1

If 20% of a number is 12, what is 30% of the same number?

A. 20
B. 24
C. 15
D. 30
E. 18

Part I - Problem 2

The sum

$$1 + 2 + 3 + 4 + 5 + \cdots + 2011$$

is equal to:

A. 1,968,407
B. 2,023,066
C. 2,011,314
D. 5,357,896
E. 2,205,500

Part I - Problem 3

Ten contestants competed on a game show. The first six contestants won an average of $80. The next four won an average of $70. The ten contestants won an average of:

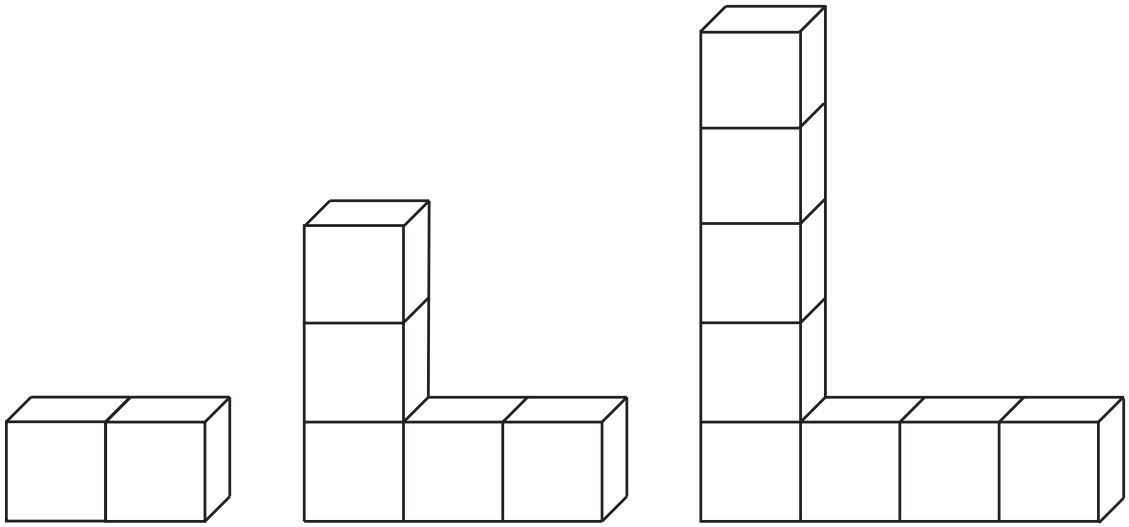
A. $74
B. $78
C. $76
D. $72
E. $75

Part I - Problem 4

An athlete's target heart rate, in beats per minute, is 80% of the theoretical maximum heart rate. The maximum heart rate is found by subtracting the athlete's age, in years, from 220. To the nearest whole number, what is the target heart rate of an athlete who is 27 years old?

A. 135
B. 154
C. 172
D. 196
E. 237

Part I - Problem 5



How many cubes in the 20th structure?

A. 28
B. 37
C. 59
D. 43
E. 40

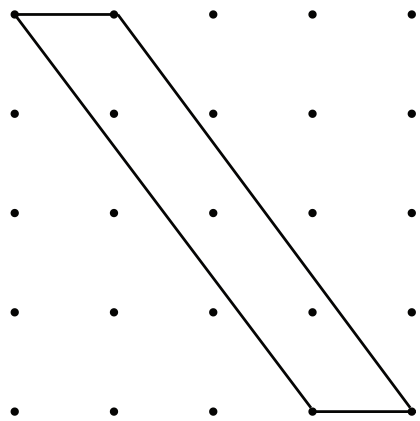
Part I - Problem 6

Uncle bookworm eats two books a week; Aunt bookworm eats one book every two months. In a year Uncle eats how many more books than Aunt eats?

A. 20
B. 98
C. 108
D. 54
E. 76

Part I - Problem 7

If the distance between dots along a row and along a column is 1 unit, then the area of the parallelogram in square units is:



A. 4 square units
B. 5 square units
C. 6 square units
D. 6.5 square units
E. 8 square units

Part I - Problem 8

In a recent month, the dates of three Sundays were even numbers. What day of the week was the 19th of the month?

A. Monday
B. Tuesday
C. Wednesday
D. Thursday
E. Friday

Part I - Problem 9

Zelda has 16 CD's, 28 DVD's, and 60 cassette tapes. She would like to share these items with three of her friends. If Zelda's share is equal to that of her friends, how many items will each person receive?

A. 108
B. 26
C. 30
D. 52
E. 24

Part I - Problem 10

This year there were $11 \times 121 - 11 \times 11$ fewer turkeys eaten than last year. How many fewer turkeys were eaten this year?

A. 120
B. 121
C. 1200
D. 1210
E. none of these

Part I - Problem 11

Solve for X:

$$(2011 + 2010 + 2009) - (2008 + 2007 + 2006) = 2000 - X$$

A. 1991
B. 2020
C. 2006
D. 9
E. none of these

Part I - Problem 12

A bakery lowered its price for cookies from \$0.50 to \$0.40 each. If Mick has \$4, how many more cookies can he buy now than he could before?

A. 1
B. 2
C. 3
D. 4
E. 5

Part I - Problem 13

Grawp wrote a word in secret code. In this code, the number 26 stood for the letter “A”, the number 25 stood for “B”, and so on. In this code, the sequence 9 26 11 11 2 represents which word?

A. RAPPY
B. DOTTY
C. HAPPY
D. RATTY
E. PATTY

Part I - Problem 14

What is the sum of the two largest primes less than 40?

A. 70
B. 52
C. 64
D. 68
E. 76

Part I - Problem 15

Twenty-seven minutes after 11 A.M. is how many minutes before 1 P.M.?

A. 33
B. 87
C. 63
D. 107
E. 93

Part I - Problem 16

$20112011201120112011 \div 2011$ is equal to:

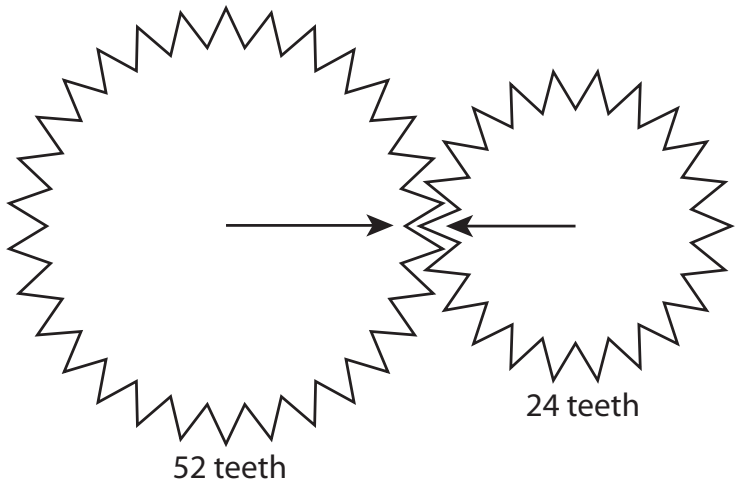
A. 11111
B. 1001001001001001
C. 1001001001001
D. 1000100010001001
E. 1000100010001

Part I - Problem 17

$(2011 - 2009) \times (2009 - 2007) \times (2007 - 2005) \times \cdots \times (5 - 3) \times (3 - 1) =$

A. 2^{1005}
B. 2^{2011}
C. 2^{4020}
D. 2^{1010}
E. 2^{510}

Part I - Problem 18



How many revolutions must the large gear make before the arrows line up again?

A. 6
B. 4
C. 24
D. 9
E. 12

Part I - Problem 19

When you divide
$(1+4)+(1+8)+(1+12)+(1+16)+(1+20)+(1+24)$
by 4 the remainder is:

A. 0
B. 1
C. 2
D. 3
E. none of these

Part I - Problem 20

Yoda has seven coins worth a total of \$0.49. How many nickels does he have?

A. 0
B. 1
C. 2
D. 4
E. 6

Part I - Problem 21

500 nickels have the same value as how many quarters?

A. 100
B. 250
C. 50
D. 75
E. 200

Part I - Problem 22

If 3 of every 150 astronauts walk on the moon, then what percentage of all astronauts walk on the moon?

A. 15
B. 50
C. 2
D. 10
E. 3

Part I - Problem 23

Two six-sided dice are rolled, each with two black, two green, and two red faces. What is the probability that both dice show the same color?

A. 1/3
B. 1/12
C. 1/36
D. 1/9
E. none of these

Part I - Problem 24

At most how many students can sit in a row of 25 chairs, if seated students must be separated by at least one empty chair?

A. 12
B. 24
C. 17
D. 13
E. 15

Part I - Problem 25

The difference between $\frac{5}{7}$ and its reciprocal is:

A. $\frac{35}{7}$

B. $\frac{24}{35}$

C. $\frac{19}{35}$

D. $\frac{7}{5}$

E. $\frac{1}{7}$

Part I - Problem 26

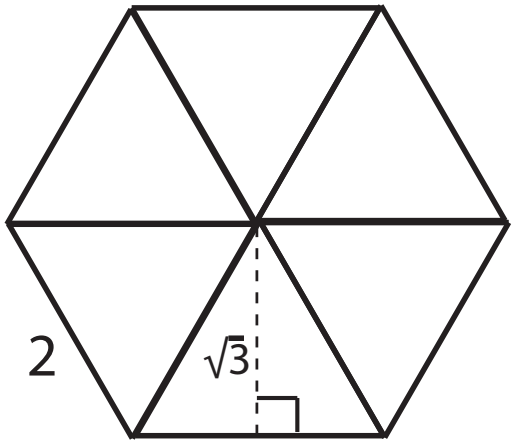
On my scooter, the rear wheel's diameter is 5 centimeters more than the front wheel's diameter. How much bigger is the rear wheel's circumference?

A. 10π centimeters
B. 5π centimeters
C. $25\pi^2$ centimeters
D. 2.5π centimeters
E. 15π centimeters

Part I - Problem 27

Pictured
is a regular hexagon.
What is its area?

- A $2\sqrt{3}$
- B $3\sqrt{3}$
- C $6\sqrt{3}$
- D $12\sqrt{3}$
- E None of these



Part I - Problem 28

If 10 widgets $=$ 15 gloops, then 24 gloops $=$ ____?____ widgets.

A. 32
B. 16
C. 12
D. 36
E. 14

Part I - Problem 29

In the number 0.1234512345 . . . (recurring) what is the 2011th digit after the decimal point?

A. 1
B. 2
C. 3
D. 4
E. 5

Part I - Problem 30

If 2/3 of a cup of fish food can feed 12 goldfish, then 4 cups of food should be able to feed how many goldfish?

A. 18
B. 76
C. 72
D. 64
E. 48

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Ready... Set... Go!

Prepare to restart the *Mad Hatter Marathon!*

Part II - Problem 1

If the Weasleys' Wizard Wheezes "OPEN" sign is a square with a perimeter of 12 feet, then the area of the sign is:

A. 3 square feet
B. 16 square feet
C. 9 square feet
D. 18 square feet
E. 24 square feet

Part II - Problem 2

The average of seven whole numbers is 7. If six of the numbers are 1, then the seventh number is:

A. 7
B. 1
C. 43
D. 28
E. 49

Part II - Problem 3

A dealer paid Bunny Fufu 50 cents for each of his decorated eggs. The dealer then sold each egg for $5. Bunny Fufu got what percentage of the purchase price for his eggs?

A. 2%
B. 25%
C. 5%
D. 20%
E. 10%

Part II - Problem 4

When fully expanded, 1000^{999} has how many digits?

A. 999
B. 9,000
C. 3,004
D. 2,998
E. 8,997

Part II - Problem 5

How many of the twelve positive factors of 200 are divisible by 4?

A. 4
B. 7
C. 6
D. 8
E. 10

Part II - Problem 6

The Terex Titan dump truck can carry 283,520 kgs of sand. Brak's pickup truck can carry 650 kgs. How many full loads of sand must Brak haul in order to equal one full load of the Terex Titan?

A. less than 300 loads
B. between 300 and 400 loads
C. between 401 and 500 loads
D. between 501 and 600 loads
E. more than 600 loads

Part II - Problem 7

$3^{2011} + 3^{2011} + 3^{2011} = \ldots$

A. 3^{6033}
B. 9^{2011}
C. 9^{6033}
D. 9^{2012}
E. 3^{2012}

Part II - Problem 8

If you have seven flavors of ice cream and three types of cones, how many different single scoop ice cream cones can you make?

A. 21
B. 7
C. 10
D. 35
E. 24

Part II - Problem 9

Data gained weight each week over a six-week period. His gains were recorded as

1.1 lbs 0.75 lb 1.2 lbs 0.5 lb 1.3 lbs 0.25 lb

What was Data's average weekly gain in pounds?

A. 0.9 lbs
B. 0.85 lbs
C. 1.2 lbs
D. 0.78 lbs
E. 1.05 lbs

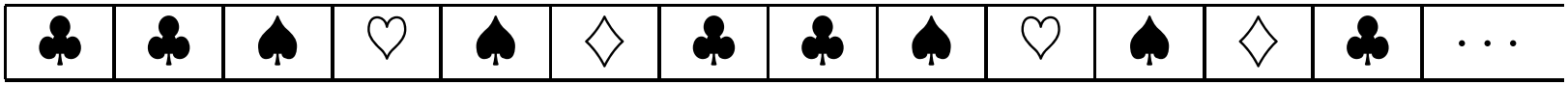
Part II - Problem 10

$$1 = 1$$
$$3 + 5 = 8$$
$$7 + 9 + 11 = 27$$
$$13 + 15 + 17 + 19 = 64$$
$$21 + 23 + 25 + 27 + 29 = 125$$

If this number triangle continues indefinitely with the same pattern, what is the sum of the 9th row?

- A 640
- B 1000
- C 1225
- D 729
- E 947

Part II - Problem 11



If this pattern continues indefinitely, what symbol will be in the 460th square?

A ♠

B ♡

C ♢

D ♣

Part II - Problem 12

Banjo the monkey has a fair coin with one side colored blue and the other side colored red. If he flips the coin three times, what is the probability that the outcome is two red and one blue (not necessarily in that order)?

A $\frac{1}{2}$

B $\frac{1}{3}$

C $\frac{1}{4}$

D $\frac{3}{8}$

E $\frac{1}{8}$

Part II - Problem 13

Wario made a list of three-digit whole numbers, and every digit used was odd. At most how many different numbers were on his list?

A. 75
B. 625
C. 525
D. 125
E. 150

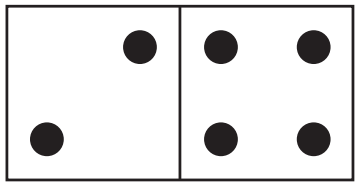
Part II - Problem 14

Last Saturday, Amelie sold her paintings at a local flea market. In the morning she sold one-third of the paintings. She sold one-fourth of the remaining paintings in the afternoon. When the market closed she had 9 paintings left. How many paintings did she bring to to the market with her that morning?

A. 24
B. 16
C. 20
D. 26
E. 18

Part II - Problem 15

A domino set contains all number pairs from double-zero to double-six with each number pair occurring only once. For example the pictured domino counts as two-four and four-two.
How many dominos are in the set?



A. 18
B. 24
C. 36
D. 28
E. 32

Part II - Problem 16

Sue is twice as old as her sister Kate. If Kate was seven a year ago, how old will Sue be three years from now?

A. 11
B. 17
C. 12
D. 15
E. 19

Part II - Problem 17

In Amidala's kitchen are three cookie jars, painted red, blue, and green. The green jar has two more cookies than the blue jar, and the blue jar has two more cookies than the red jar. If there is a combined total of 30 cookies in the three jars, then how many cookies are in the red jar?

A. 7
B. 10
C. 8
D. 6
E. 11

Part II - Problem 18

A company is considering the installation of a solar power system in order to save on utility bills. The cost of installing the system is \$15,000 and the monthly savings would be \$100. How many years would it take the company to recoup the cost of installing the system?

- A $12\frac{1}{2}$ years
- B $10\frac{1}{4}$ years
- C $14\frac{3}{4}$ years
- D $11\frac{3}{4}$ years
- E $12\frac{1}{4}$ years

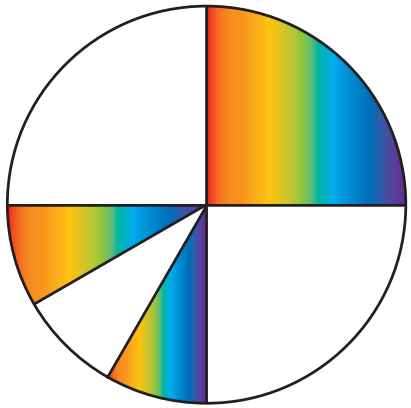
Part II - Problem 19

7 kilograms plus 27 grams plus 71 milligrams equals how many grams?

A. 103
B. 727.21
C. 7027.71
D. 7027.071
E. 7.98

Part II - Problem 20

What fraction of the circle is colored?



A $\frac{3}{6}$

B $\frac{4}{6}$

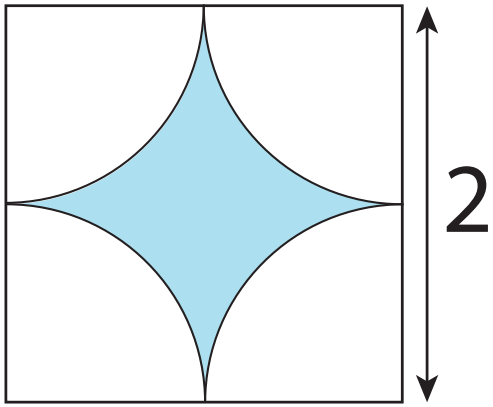
C $\frac{3}{4}$

D $\frac{4}{5}$

E $\frac{5}{12}$

Part II - Problem 21

Pictured is a square. The four circular arcs each have their center at a corner of the square. What is the area of the shaded region?



A π

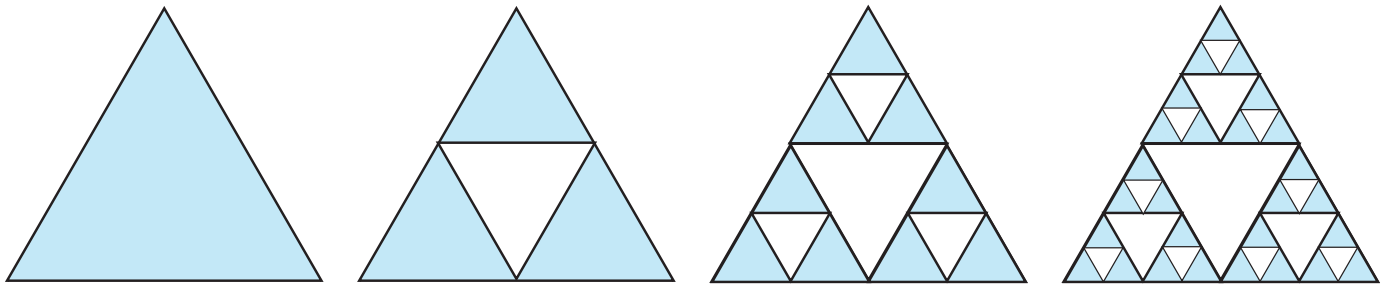
B 2

C $\pi - 2$

D $\frac{\pi}{2}$

E $4 - \pi$

Part II - Problem 22



If this pattern continues, how many white triangles will there be in the next figure?

- A 33
- B 60
- C 81
- D 48
- E 40

Part II - Problem 23

Of the following, which has an odd quotient when divided by 2?

A. 456,456,456,456,456
B. 678,678,678,678,678
C. 432,432,432,432,432
D. 876,876,876,876,876
E. 380,380,380,380,380

Part II - Problem 24

Pretend your class has fewer than 40 students. When your class gets into groups of 5 there are two students left over. When your class gets into groups of 7, there are four students left over. How many students are in your class?

A. 17
B. 32
C. 37
D. 27
E. 22

Part II - Problem 25

If my bad hair day began 840 minutes before 8:40 PM, then my bad hair day began at:

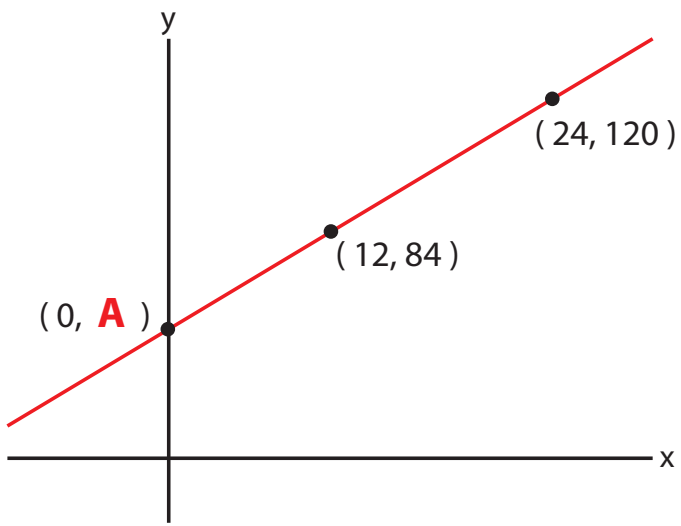
A. 7:40 AM
B. 7:20 AM
C. 8:40 AM
D. 6:10 AM
E. 6:40 AM

Part II - Problem 26

Madeleine has two 600 ml pitchers of orange juice. One pitcher is 1/3 full and the other is 2/5 full. If she adds water to fill each pitcher completely, then pours both pitchers into one large container, what fraction of the mixture in the large container is orange juice?

A. 3/8
B. 1/8
C. 11/30
D. 4/15
E. 9/16

Part II - Problem 27



What is the value of **A** above?

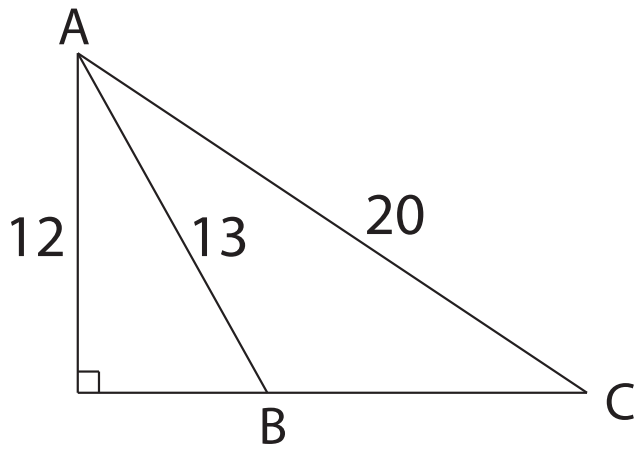
A. 84
B. 12
C. 26
D. 48
E. 50

Part II - Problem 28

Clank imagined two thousand whole numbers whose product is equal to 2000. What is the greatest possible sum of Clank's numbers?

A. 2011
B. 3999
C. 5015
D. 407
E. 9831

Part II - Problem 29



What is the area of triangle ABC?

- A 48
- B 59.5
- C 64
- D 66
- E 72.5

Part II - Problem 30

If $X \diamondsuit Y$ means $\frac{X+Y}{2}$ then $(5 \diamondsuit 7) \diamondsuit 10$ is

A. 8
B. 16
C. 12
D. 6
E. 30

Solutions

The correct answer choices are on the next page.

Part I

1	e	2	b	3	c	4	b	5	c	6	b
7	a	8	c	9	b	10	d	11	a	12	b
13	a	14	d	15	e	16	d	17	a	18	a
19	c	20	a	21	a	22	c	23	a	24	d
25	b	26	b	27	c	28	b	29	a	30	c

Part II

1	c	2	c	3	e	4	d	5	c	6	c
7	e	8	a	9	b	10	d	11	b	12	d
13	d	14	e	15	d	16	e	17	c	18	a
19	d	20	e	21	e	22	e	23	b	24	b
25	e	26	c	27	d	28	b	29	d	30	a