Hu Wants to be a Mathematician

All-Day Sprint
College of Charleston Math Meet 2009

On the back of this page is a fill-in-the-blank test where you must complete the story by putting the appropriate words in the right places. As is often the case with these Math Meet puzzles, the story itself is nothing but propaganda. (Sorry. We can't help ourselves.) But, there is a bit of mathematics going on here as well. Instead of just giving you the list of words to put in the blanks, we have first encoded them mathematically.

Here's the way it works. We associate each letter of the alphabet to a number using the simple correspondence $A = 0$, $B = 1$, $C = 2$, ..., $Z = 25$. Then, we come up with a function $f(n)$ that turns whole numbers into whole numbers (like $f(n) = n!$ or $f(n) = n^3$) and use it to encode the words. Specifically, we replace the letter corresponding to n by the letter corresponding to $f(n) \bmod 26$. That gives us:

WORD LIST

1. $f(n) = n + 3 \Rightarrow$ DFWXDUB

2. $f(n) = n^2 \Rightarrow$ ARKQBDA

3. $f(n) = -(n + 1) \Rightarrow$ ZMZOBHRH

4. $f(n) = n + 13 \Rightarrow$ ORYOEHAB

5. $f(n) = (n + 2)^2 \Rightarrow$ QEXKKX

6. $f(n) = \frac{n(n+1)}{2} \Rightarrow$ DCABP

7. $f(n) = n^4 \Rightarrow$ JW

8. $f(n) = 2n \Rightarrow$ WOYCIISAEU

9. $f(n) = n^2 + 1 \Rightarrow$ PBYYRPBYNFNBO

10. $f(n) = -n + 5 \Rightarrow$ TFMYUBMB

11. $f(n) = n + 7 \Rightarrow$ WYHJAPJHS

12. $f(n) = 11n \Rightarrow$ FANHYC

13. $f(n) = -2n \Rightarrow$ QAEASE

14. $f(n) = n \bmod 17 \Rightarrow$ BACIBFACCION

15. $f(n) = n + 1 \bmod 17 \Rightarrow$ CQBDFCIJQC

16. $f(n) = 2n \Rightarrow$ KMAMQKMQEQAA

17. $f(n) = n \bmod 6 \Rightarrow$ ABFEAA

Let's illustrate the idea by looking at number 9. Since the function is $f(n) = n^2 + 1$, we can easily see that $f(0) = 1$ and $1 \bmod 26$ is 1 so an "A" in the original word will become a "B". The second letter in the coded word 9 is a "B" and in fact the second letter of the answer is in fact an "A". However, it is not always that simple. Note that both "M" and "O" will be encoded as a "P" (because $f(12)$ and $f(14)$ are both 15 modulo 26). So, the first letter could be either one of those. Similarly, the "Y" in the third and fourth place of the word could have come from either an "H" or a "T". At this point, a bit of non-mathematical ability (psychology, perhaps) may help you recognize that the word could begin with the letters "MATH"...and that it has the same number of letters as "MATHEMATICIAN" which appears in the title of this Sprint and...hey, it works! (Good luck with the rest of them...and don't fall for the evil propaganda, even though everything it says is 100% true!)

Steven _____ is a high school student who is not sure what he will do after graduation. Although he represents his school as a "_____" at competitions, he has never considered a _____ in math. In fact, he did not even realize it was a possibility. Then, he saw the headline which said that "_____" was rated the number *one* job in America in January 2009 by the author of the annual "Jobs Rated Almanac" and `careercast.com`! The job which came in second place was "_____", which is the title for the person who calculates probabilities for insurance companies. And the *third* ranked job according to this report was "_____", a person who collects and analyzes data mathematically.

According to the article, these jobs scored well because of high average _____, low levels of _____ and lots of job _____. But, what Steven really noticed was that all three of the top ranked jobs require a college degree in a mathematical science.

So, Steven looked around on the internet and found out more about studying math at college than he knew before. He learned that almost all math majors take courses in _____ (which seems to be a sort of advanced calculus) and abstract _____ (where the word "multiplication" takes on a whole new meaning). Other possible courses include things like Topology, Bayesian Statistics, and _____ Theory.

That last course name sounded particularly interesting, so he Googled it and found that it is a branch of math that studies the hidden order of things that may initially look completely _____. One of the big successes of this theory is the work of Ed _____, a mathematician who figured out how to use it to fly _____ anywhere in the solar system using almost no fuel. (His system is now frequently used by NASA and other countries' space programs.)

Even if he had not heard that it was a highly rated job, that sounded pretty cool to Steven. Knowing that it was also considered to be the best job in the country for more _____ reasons helped Steven to make up his mind. He had decided that after graduating from high school, he would either go to college and study math *or* become a _____ (a job which came in at 200th place in the rankings, but Steven liked the smell of sawdust).