Quiz 1

---

1. What is part of practically every programming language?

A. Input/output.
B. Mathematical operations.
C. Conditional execution.
→*D*. All of the above.
E. None of the above.

---

2. What is a feature of formal languages that is not a feature of natural languages?

A. Ambiguity.
B. Redundancy.
→*C*. Literalness.
D. All of the above.
E. None of the above.

---

3. Which kind of computer code is executed in hardware?

A. Source code.
B. Byte code.
→*C*. Object code.
D. All of the above.
E. None of the above.

---

4. What sort of error is a misspelling?

→*A*. Syntactic.
B. Runtime.
C. Semantic.

---

5. What is an advantage that a high-level language has over a low-level language?

→*A*. Portability.
B. Faster run time.
C. Streamlined syntax.
D. All of the above.
E. None of the above.

Quiz 2

---

1. What is python's assignment operator?

A. def
B. type
C. assert
→*D*. None of the above.

---

2. In python, what is a variable?

→*A*. A name that refers to a value.
B. The value assigned to a name.
C. The type of a quantity.
D. None of the above.

---

3. In python, what would be the type of 3.2?

→*A*. float
B. int
C. str
D. None of the above.

---

4. In python, what is a statement?

→*A*. An instruction that the interpreter can execute.
B. A combination of values, variables, and operators.
C. An expression that the interpreter can evaluate.
D. All of the above.
E. None of the above.

---

5. In python, what appears on the right-hand side of an assignment statement?

A. A statement.
→*B*. An expression.
C. A module.
D. All of the above.
E. None of the above.

Quiz 3

---

1. Which set is in one-to-one correspondence with the collection of subsets of a set of size n?

→*A*. The set of integers from 0 to $2^n - 1$.
B. The set of integers from 0 to 2^{n-1}.
C. The set of integers which can be expressed in binary form.
D. None of the above.

---

2. The integer part of x is the integer k such that

A. $10^{k-1} \leq 2^x < 10^k$.
→*B*. $k \leq x < k + 1$.
C. $|x - k| < 1$.
D. None of the above.

---

3. Sets A and B are disjoint when

→*A*. their intersection is the empty set.
B. their union is the empty set.
C. their union equals their intersection.
D. All of the above.
E. None of the above.

---

4. The number of *unordered* k-subsets of a set with n elements is

→*A*. $\binom{n}{k}$.
B. $n!/k!$.
C. $n!/(n-k)!$.
D. None of the above.

---

5. If A is a set then $|A|$ denotes

A. the collection of subsets of A.
B. the set of all permutations of A.
→*C*. the cardinality of A.
D. None of the above.

Quiz 4

---

1. Let S be a set with n elements. How many decimal digits are there in the number of subsets of S.

A. $1 + \lfloor 10 \log_2(n) \rfloor$

B. $1 + \lfloor n \log_2(10) \rfloor$

→C. $1 + \lfloor n \log_{10}(2) \rfloor$

D. None of the above.

---

2. $\displaystyle\sum_{k=0}^{n} \binom{n}{k} =$

A. $n!$.

B. n^k.

→C. 2^n.

D. None of the above.

---

3. What is the $\displaystyle\sum_{k=1}^{n}(2k-1)$?

A. $2n - 1$.

B. $(2n-1)^2$.

→C. n^2.

D. None of the above.

---

4. What information can we get from Stirling's formula?

A. An asymptotic estimate for the factorial.

B. An estimate for the number of decimal digits of the factorial.

C. An estimate for the number of binary bits of the factorial.

→D. All of the above.

E. None of the above.

---

5. What does the "$\sim$" in Stirling's Formula mean?

→A. The ratio of the two expressions approaches 1 as $n \to +\infty$.

B. The difference of the two expressions approaches 0 as $n \to +\infty$.

C. The two expressions are nearly equal for all sufficiently large n.

D. All of the above.

E. None of the above.

Quiz 5

---

1. What is the difference between the n-th square and the $(n-1)$-st?

A. The $(n-1)$-st square.
B. The $(n-1)$-st odd number.
→*C*. The n-th odd number.
D. None of the above.

---

2. Stirling's Formula tells us that as $n \to \infty$

A. $n! \sim (n/e)^n \sqrt{2\pi n}$.
B. The ratio of $n!$ to $(n/e)^n \sqrt{2\pi n}$ approaches 1.
C. The difference between $\log(n!)$ and $\log\left[(n/e)^n \sqrt{2\pi n}\right]$ approaches 0.
→*D*. All of the above.
E. None of the above.

---

3. True or false: The number of bits in the binary expression of $n!$ is roughly $n \log_2(n/e) + \frac{1}{2} \log_2(n)$. *False.*

---

4. True or false: If n is even then the number of even-size subsets of an n-set is one less than the number of odd-size subsets of an n-set. *False.*

---

5. True or false: There are more 2-letter strings of lower-case letters than there are permutations of the set $\{1, 2, 3, 4, 5, 6, 7\}$. *False.*

Quiz 6

---

1. What is a feature of a python function?

A. Its definition is a sequence of statements.
B. It may or may not take parameters.
C. It may or may not produce a result.
→*D*. All of the above.
E. None of the above.

---

2. In python, what is a function call?

A. The name of a function.
→*B*. A statement that executes a function.
C. The order in which statements are executed.
D. All of the above.
E. None of the above.

---

3. In python, what is a local variable?

A. A value provided to a function when the function is called.
→*B*. A variable defined inside a function.
C. The values assigned to a function's parameters.
D. All of the above.
E. None of the above.

---

4. Which python statement permits functions and variables defined in a script to be brought into another environment?

A. def
→*B*. import
C. apply
D. All of the above.
E. None of the above.

---

5. What's the moral of the "sordid tale" of functions?

A. Read a program from top to bottom.
→*B*. Follow the flow of execution.
C. Write your code so that the flow of execution runs from top to bottom.
D. All of the above.
E. None of the above.

Quiz 7

---

1. The Binomial Theorem was discovered first by
A. An English physicist.
B. A French philosopher.
C. A Greek astronomer.
→*D*. None of the above.

---

2. $\sum_{k=0}^{n}(-1)^k\binom{n}{k} =$
A. $n!$.
B. 2^n.
C. $\binom{2n}{n}$.
→*D*. None of the above.

---

3. $\sum_{k=0}^{n}\binom{n}{k}^2 =$
A. $n!$.
B. 2^n.
→*C*. $\binom{2n}{n}$.
D. None of the above.

---

4. The number of ways to distribute n identical pennies to k children so that each child gets at least one is
A. $\binom{n}{k}$.
B. $\binom{n+k-1}{k-1}$.
→*C*. $\binom{n-1}{k-1}$.
D. None of the above.

---

5. The number of ways to distribute n identical pennies to k children is
A. $\binom{n}{k}$.
→*B*. $\binom{n+k-1}{k-1}$.
C. $\binom{n-1}{k-1}$.
D. None of the above.

Quiz 8

---

1. What does the eagle see when she looks at Pascal's triangle?

→*A.* $\binom{2m}{m-t} \Big/ \binom{2m}{m} \approx e^{-t^2/m}$.

B. $\binom{n}{k+1} \Big/ \binom{n}{k} = \dfrac{n-k}{k+1}$.

C. $\dfrac{1}{n+1}\binom{2n}{n} < 2^n < \binom{2n}{n}$.

D. None of the above.

---

2. If $f, g > 0$ and $f \sim g$ then

A. $f \approx g$.

B. $f - g \to 0$.

→*C.* $f/g \to 1$.

D. All of the above.

E. None of the above.

---

3. If $f, g > 0$ and $f \sim g$ then

A. $\log(f) \approx \log(g)$.

B. $\log(f) - \log(g) \to 0$.

C. in the large, f and g have the same number of digits.

→*D.* All of the above.

E. None of the above.

---

4. De Moivre's version of Stirling's Formula can be proved by using the Riemann sums to estimate

→*A.* $\displaystyle\int_1^n \log(x)\,dx$.

B. $\displaystyle\int_1^n \frac{dx}{x}$.

C. $\displaystyle\int_1^n \frac{dx}{\log(x)}$.

---

5. The trapezoidal approximation to the integral used in de Moivre's formula has an error that is

A. positive.

B. increasing in n.

C. bounded above by 1.

→*D.* All of the above.

E. None of the above.

Quiz 9

---

1. In python, what is the value of 5%2 == 0?

A. 2.
B. 1.
C. 0.
→*D*. None of the above.

---

2. What technique does our python tutorial suggest for dealing with increasingly complex programs?

A. Dynamic typing.
→*B*. Incremental development.
C. Object orientation.
D. All of the above.
E. None of the above.

---

3. What does our python tutorial suggest is helpful for building the program but is not part of the final product?

A. Raw input.
→*B*. Scaffolding.
C. Blueprints.
D. All of the above.
E. None of the above.

---

4. What python module automagically implements unit testing?

A. unit
B. test_unit
C. gasp
→*D*. None of the above.

---

5. What is involved in tracing?

A. "Becoming the computer".
B. Following the flow of execution through a sample program run.
C. Recording the state of all variables and any output the program generate.
→*D*. All of the above.
E. None of the above.

Quiz 10

---

1. If a sequence a_n satisfies the recursive relation $a_{n+1} = a_n + a_{n-1}$ then $a_n =$

A. the n-th Fibonacci number.
B. the n-th Lucas number.
C. the n-th staircase number.
→D. There is not enough information to decide.

---

2. If $x = \lim_{n\to\infty} \frac{F_{n+1}}{F_n}$ then

A. $x = 1$.
B. $x = 1/x$.
→C. $x = 1 + 1/x$.
D. None of the above.

---

3. If n is large then $F_{n+1} \approx$

→A. $\frac{1}{2}(1+\sqrt{5}) \cdot F_n$.
B. $\frac{1}{2}(1+\sqrt{5})/F_n$.
C. $\log_{\frac{1}{2}(1+\sqrt{5})}(F_n)$.
D. None of the above.

---

4. $\sum_{k=0}^{n} F_k =$

A. F_{n+1}.
B. F_{n-1}.
C. $2F_n$.
→D. None of the above.

---

5. $F_{a+1}F_{b+1} + F_aF_b =$

→A. F_{a+b+1}.
B. F_{ab+1}.
C. $(F_a + 1)(F_b + 1)$.
D. None of the above.

Quiz 11

---

1. If A and B are independent events then
→*A*. $P(A \cap B) = P(A)P(B)$.
B. $P(A \cup B) = P(A)P(B)$.
C. $P(A \cup B) = P(A) + P(B)$.
D. All of the above.
E. None of the above.

---

2. A subset of a sample space is called
A. a sample.
B. an outcome.
→*C*. an event.
D. All of the above.
E. None of the above.

---

3. The set of all possible outcomes is called
→*A*. the sample space.
B. the probability distribution.
C. exclusive event.
D. All of the above.
E. None of the above.

---

4. One can prove a precise formulation of the Law of Large Numbers using things we have learned about
A. the Fibonacci sequence.
→*B*. Pascal's triangle.
C. binary arithmetic.
D. All of the above.
E. None of the above.

---

5. One can use the Law of Large Numbers to prove
A. the Law of Small Numbers
B. the Law of Very Large Numbers.
C. the Law of Very Small Numbers.
D. All of the above.
→*E*. None of the above.

Quiz 12

---

1. What is the sieve of Eratosthenes good for?

A. To prove that there are infinitely many primes.
B. To solve the Chinese Remainder Problem.
C. To locate perfect numbers.
D. All of the above.
→*E*. None of the above.

---

2. What is the extended euclidean algorithm good for?

A. To prove that there are infinitely many primes.
→*B*. To solve the Chinese Remainder Problem.
C. To locate perfect numbers.
D. All of the above.
E. None of the above.

---

3. If p is a prime and a is any integer then p divides

A. a^p.
→*B*. $a^p - a$.
C. $(a-1)^p$.
D. All of the above.
E. None of the above.

---

4. The statement that the density of primes near n is approximately $1/\log(n)$ is known as

A. Goldbach's Conjecture.
B. the Riemann Hypothesis.
→*C*. the Prime Number Theorem.
D. None of the above.

---

5. If $\pi(x)$ denotes the number of primes less than x then

A. $\pi(x) \sim x \log(x)$.
→*B*. $\pi(x) \sim x/\log(x)$.
C. $\pi(x) \sim \log(x)/x$.
D. None of the above.

Quiz 13

---

1. The Prime Number Theorem states that

A. the density of primes near N is asymptotically $1/\log(N)$.
B. the number of primes less than N is asymptotically $\int_2^N dt/\log(t)$.
C. the number of primes less than N is asymptotic to $N/\log(N)$.
→*D*. All of the above.
E. None of the above.

---

2. The Riemann Hypothesis

A. states that the nonreal zeroes of the zeta function have real part $\frac{1}{2}$.
B. implies the Prime Number Theorem.
C. is one of the most important unsolved problems in mathematics.
→*D*. All of the above.
E. None of the above.

---

3. If p is a prime then

A. $p \mid ab \implies$ either $p \mid a$ or $p \mid b$.
B. $\gcd(a,p) = 1 \implies p \mid a^{p-1} - 1$.
C. $p \mid (p-1)! + 1$.
→*D*. All of the above.
E. None of the above.

---

4. True or false: If $\gcd(a,p) = 1 \implies p \mid a^{p-1} - 1$ then p is prime. *False.*

---

5. In the third century Sun Tzu stated that a system of simultaneous congruences $x \equiv a_i \bmod n_i$ could be solved provided that

→*A*. $\gcd(n_i, n_j) = 1$ whenever $i \neq j$.
B. $\gcd(a_i, a_j) = 1$ whenever $i \neq j$.
C. $\gcd(a_i, n_j) = 1$ whenever $i \neq j$.
D. All of the above.
E. None of the above.

Quiz 14

---

1. In python, what is the dot operator good for?
A. To concatenate strings.
B. To access elements of a string.
→*C*. To access functions inside a module.
D. All of the above.
E. None of the above.

---

2. In python, what is an index?
A. A compound data type which mimics an ordered set.
→*B*. A variable or value used to select a member of an ordered set.
C. An iteration through the elements of an ordered set.
D. All of the above.
E. None of the above.

---

3. In python, what is the use of the break statement?
→*A*. To immediately leave the body of a loop.
B. To extract a segment of a string or other ordered set.
C. To wrap a long python expression onto more than one line.
D. All of the above.
E. None of the above.

---

4. In python, what is it called when you create a new object that has the same value as an existing object?
A. To copy.
→*B*. To clone.
C. To alias.
D. None of the above.

---

5. In python, what is it called when you create a new reference to an existing object?
A. To copy.
B. To clone.
→*C*. To alias.
D. None of the above.

Quiz 15

---

1. After python evaluates a=[1,2,3]; b=a[:]; a.pop() what is the value of b?
→*A.* [1,2,3]
B. [1,2]
C. 3
D. None of the above.

---

2. In python, what is the value of range(3,2,-1)?
A. [3,2,-1]
B. [3,2]
→*C.* [3]
D. None of the above.

---

3. In python, what is the value of '2**3 = %d' % 2**3?
A. 8
→*B.* '2**3 = 8'
C. '2**3 = 2**3'
D. None of the above.

---

4. After python evaluates def spam(a,b=2): return a+b what is the value of spam(3)?
A. 2
→*B.* 5
C. A runtime error.
D. None of the above.

---

5. After python evaluates a=[1,2]; del a[1] what is the value of a?
→*A.* [1]
B. [2]
C. [1,2]
D. None of the above.

Quiz 16

---

1. In python, what do we call the syntactic container which permits the same name to be used in different locations?

A. Module.
B. Class.
→*C*. Namespace.
D. None of the above.

---

2. In python, how do we access attributes of a module or object?

A. A function call.
B. A slice.
→*C*. The dot operator.
D. None of the above.

---

3. In python, what is created when a runtime error occurs?

A. A stack overflow.
B. A buffer overflow.
C. A segmentation fault.
→*D*. None of the above.

---

4. In python, how should a tail-recursive procedure be rewritten?

→*A*. As an iterative procedure.
B. By an exception handler.
C. Using list comprehension.
D. None of the above.

---

5. In python, which of the following are mutable data types?

A. Tuples.
→*B*. Lists.
C. Strings.
D. All of the above.
E. None of the above.

Quiz 17

---

1. In python, what sort of clause do you use to handle an exception?

A. raise: ... except: ...
B. raise: ... try: ...
→*C*. try: ... except: ...
D. None of the above.

---

2. In python, what keyword do you use to create an exception?

A. except
B. try
→*C*. raise
D. None of the above.

---

3. If we think of a python dictionary as a mathematical map, what is its domain?

A. Mutable objects.
→*B*. Immutable objects.
C. All objects.
D. None of the above.

---

4. If we think of a python dictionary as a mathematical map, what is its range?

A. Mutable objects.
B. Immutable objects.
→*C*. All objects.
D. None of the above.

---

5. What is the focus of object-oriented programming?

A. Writing functions which operate on data.
B. Constructing recursive data types.
→*C*. Combining data and functionality.
D. All of the above.
E. None of the above.

Quiz 18

---

1. In python, what gadget implements the principal idea of object-oriented programming?

A. Dictionary.
B. Recursion.
→*C*. Classes.
D. None of the above.

---

2. In python, how do we instantiate a class named spam?

A. new(spam)
B. spam.new()
C. new spam
D. All of the above.
→*E*. None of the above.

---

3. In python, what does the dictionary method items() return?

→*A*. A list of key-value pairs in the dictionary.
B. A list of the distinct values in the dictionary.
C. A list of the distinct keys in the dictionary.
D. None of the above.

---

4. In python, how do we invoke the method eggs of the object spam?

A. eggs.spam()
→*B*. spam.eggs()
C. spam(eggs)
D. None of the above.

---

5. In python, what method is invoked when we instantiate an object?

→*A*. __init__
B. __new__
C. __class__
D. All of the above.
E. None of the above.

Quiz 19

---

1. What does it mean when we write that $a \equiv b \bmod n$?

A. a and b leave the same remainder when divided by n.
B. $a - b$ is divisible by n.
C. $a = b + kn$, for some integer k.
→*D*. All of the above.
E. None of the above.

---

2. What is the key to finding the multiplicative inverse of a modulo n?

→*A*. The euclidean algorithm.
B. Wilson's Theorem.
C. Fermat's Little Theorem.
D. All of the above.
E. None of the above.

---

3. If $p_1, \ldots, p_k$ are the distinct prime factors of n, then what is $n \prod_{j=1}^{k} (1 - \frac{1}{p_j})$?

A. The number of positive integers in the interval $[1, n]$ which are relatively prime to n.
B. The number of invertible congruence classes modulo n.
C. $\phi(n)$.
→*D*. All of the above.
E. None of the above.

---

4. Suppose that $2^{n-1} \equiv 1 \bmod n$. What can you conclude about n?

A. That n is prime.
B. That n is composite.
→*C*. Neither of these.

---

5. Suppose that $2^{n-1} \not\equiv 1 \bmod n$. What can you conclude about n?

A. That n is prime.
→*B*. That n is composite.
C. Neither of these.

Quiz 20

---

1. What does it mean that a "true/false" property is of class NP (nondeterministic polynomial time)?

→*A*. If the answer is "true" then this can be exhibited in a manner that is quickly verified.
B. If the answer is "false" then this can be exhibited in a manner that is quickly verified.
C. You can quickly determine whether the answer is "true" or "false".
D. All of the above.
E. None of the above.

---

2. What does it mean that a "true/false" property is of class P (polynomial time)?

A. If the answer is "true" then this can be exhibited in a manner that is quickly verified.
B. If the answer is "false" then this can be exhibited in a manner that is quickly verified.
→*C*. You can quickly determine whether the answer is "true" or "false".
D. All of the above.
E. None of the above.

---

3. The text claims that modern cryptography began in the 1970s, with the discovery of what?

A. The failure of substitution codes.
B. The provable security of one-time pads.
→*C*. The role of computational complexity.
D. All of the above.
E. None of the above.

---

4. In the text's example, what helps protect your password at an ATM?

A. That you can quickly find large random primes.
B. That checking whether a given prime divides a given number.
C. That it is hard to find the prime factors of a given number.
→*D*. All of the above.
E. None of the above.

---

5. In the RSA cryptosystem, what enables Alice to decrypt messages?

A. Fermat's Theorem.
B. Euclid's algorithm.
C. The Indian power-mod algorithm.
→*D*. All of the above.
E. None of the above.

Quiz 21

---

1. What does Alice want to do?
- *A*. Organize a coup d'etat.
- *B*. Fiddle her tax returns.
- *C*. Minimize her phone bill.
- →*D*. All of the above.
- *E*. None of the above.

---

2. Who is Bob?
- →*A*. A stockbroker.
- *B*. A good friend of Alice.
- *C*. A member of the secret police.
- *D*. All of the above.
- *E*. None of the above.

---

3. Why does Alice use source coding?
- *A*. To evade the secret police.
- →*B*. To save on her phone bills.
- *C*. To overcome the pops and crackles in a noisy phone line.
- *D*. All of the above.
- *E*. None of the above.

---

4. Why does Alice use channel coding?
- *A*. To evade the secret police.
- *B*. To save on her phone bills.
- →*C*. To overcome the pops and crackles in a noisy phone line.
- *D*. All of the above.
- *E*. None of the above.

---

5. What is a coding theorist?
- *A*. Someone who wants to help Alice.
- *B*. Someone who wants to stop Alice.
- *C*. Someone who thinks Alice is sane.
- →*D*. All of the above.
- *E*. None of the above.

Quiz 22

---

1. Besides the file name, what is the second argument required when creating a new file object in python?

→*A*. Mode.
B. Size.
C. Character encoding.
D. Data type.
E. None of the above.

---

2. In python, which of the following are methods of a file object?

A. read
B. write
C. close
→*D*. All of the above.
E. None of the above.

---

3. Which is an example of Public Key Cryptography?

A. Substitution ciphers.
B. One-time pads.
→*C*. RSA.
D. All of the above.
E. None of the above.

---

4. In the RSA cryptosystem, how is Fermat's theorem used?

A. To find large random primes.
→*B*. To encrypt messages.
C. To decrypt messages.
D. All of the above.
E. None of the above.

---

5. What lends heuristic support to the sense of security regarding RSA?

→*A*. The apparent difficulty in factoring large numbers.
B. The apparent randomness of large primes.
C. The anticipation that the Riemann hypothesis will soon be solved.
D. All of the above.
E. None of the above.

Quiz 23

---

1. The idea for a set of Millennium Problems was inspired by whose famous address at the 2nd International Congress of Mathematicians?

→*A*. David Hilbert.

B. Timothy Gowers.

C. Sir Michael Atiyah.

D. John Tate.

E. None of the above.

---

2. How many Millennium Problems are there?

A. 3

B. 5

C. 12

D. 23

→*E*. None of the above.

---

3. What is the subject of the conjecture of Birch and Swinnerton-Dyer?

A. A general method for determining when an algebraic equation has integer solutions.

B. A general method for determining the zeroes of the ζ-function of an abelian variety.

→*C*. An amazing link between the vanishing of $\zeta(1)$ and the number of integer points on certain abelian varieties.

D. None of the above.

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4. What is the subject of the Riemann Hypothesis?

A. A general method for determining when an algebraic equation has integer solutions.

B. A general method for determining the zeroes of the ζ-function of an abelian variety.

C. An amazing link between the vanishing of $\zeta(1)$ and the number of integer points on certain abelian varieties.

→*D*. None of the above.

---

5. What is the problem P vs NP?

→*A*. Are there questions whose answer can be quickly checked, but which require an impossibly long time to solve by any direct procedure?

B. Are there questions whose answer can be found quickly, but which require an impossibly long time to verify?

C. Are there questions whose answer requires both an impossibly long time to solve and an impossibly long time to verify?

D. None of the above.

Quiz 24

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1. What is the *rank* of an elliptic curve?

A. The number of independent basis points of finite order.
→*B*. The number of independent basis points of infinite order.
C. The number of independent basis points of arbitrary order.
D. None of the above.

---

2. The conjecture of Birch and Swinnerton-Dyer equates the rank of an elliptic curve to what?

→*A*. The lowest-degree exponent of the Taylor expansion of its L-function at $s = 1$.
B. The lowest-degree coefficient of the Taylor expansion of its L-function at $s = 1$.
C. The highest-degree exponent of the Taylor expansion of its L-function at $s = 1$.
D. None of the above.

---

3. What led Birch and Swinnerton-Dyer to their conjecture?

→*A*. Numerical computations on one of the earliest electronic computers.
B. The increasing weight of evidence from the proofs of other arithmetical conjectures.
C. A geometric reformulation of Hilbert's eight problem.
D. None of the above.

---

4. What is the Riemann hypothesis?

A. The ζ-function has no zeroes on the line where the real part of $s = 1$.
→*B*. The nontrivial zeroes of the ζ-function lie on the line where the real part of $s = \frac{1}{2}$.
C. The ζ-function has a simple zero at each of the negative even integers.
D. None of the above.

---

5. What led Riemann to his hypothesis?

A. A study of the arithmetic of elliptic curves.
B. A study of the geometry of complex analytic functions.
→*C*. A study of the distribution of prime numbers.
D. None of the above.

Quiz 25

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1. What do we know about the complexity classes P and NP?
→*A*. P $\subset$ NP.
B. NP $\subset$ P.
C. P $\neq$ NP.
D. None of the above.

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2. What do most mathematicians expect to be true about P and NP?
A. P = NP.
B. NP $\subset$ P.
→*C*. P $\neq$ NP.
D. None of the above.

---

3. What does it mean for a computational problem to be NP-complete?
A. It is completely solvable in polynomial time.
B. It is completely unsolvable in polynomial time.
C. It is completely undecidable in polynomial time.
→*D*. None of the above.

---

4. Which of the following problems are NP-complete?
A. Minesweeper.
B. SAT.
C. Traveling salesman.
→*D*. All of the above.
E. None of the above.

---

5. Which of the following problems are in class P?
→*A*. Factoring.
B. Sorting.
C. Traveling salesman.
D. All of the above.
E. None of the above.