Quiz 1

---

1. How many subsets does a set with n elements contain?

A. $\binom{n}{k}$.

B. $n!$.

$\rightarrow C$. 2^n.

D. All of the above.

E. None of the above.

---

2. If k is an integer and $k \leq x < k+1$ then

A. $k = \lfloor x \rfloor$.

B. k is the integer part of x.

C. k is the floor of x.

$\rightarrow D$. All of the above.

E. None of the above.

---

3. The number of permutations of n objects is

A. $\binom{n}{k}$.

$\rightarrow B$. $n!$.

C. 2^n.

D. All of the above.

E. None of the above.

---

4. If k and n are integers and $0 < k < n$ then

A. $\binom{n}{k} = \binom{n}{n-k}$.

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

C. $\binom{n}{k}$ is the number of k-subsets in a set of size n.

$\rightarrow D$. All of the above.

E. None of the above.

---

5. If A and B are sets then their symmetric difference is the set of elements

A. in neither A nor B.

B. in both A and B.

$\rightarrow C$. in A or B but not both.

D. All of the above.

E. None of the above.

Quiz 2

---

1. What is the sum of the first n odd integers?

A. $n(n+1)/2$.

B. $n(n+1)/4$.

C. $n(n+1)(2n+1)/6$.

D. All of the above.

$\rightarrow E$. None of the above.

---

2. The Principle of Mathematical Induction says that, for a given property of natural numbers,

$\rightarrow A$. if the base case is true and the inductive hypothesis is true for all natural number, then the property is true for every natural number.

B. if the base case is true then the inductive hypothesis is true for every natural number.

C. if the inductive hypothesis is true for every natural number then the base case is also true.

D. All of the above.

E. None of the above.

---

3. What is Stirling's formula?

$\rightarrow A$. An asymptotic estimate for the factorial.

B. A "closed form" for the factorial.

C. An inductive proof for the factorial.

D. All of the above.

E. None of the above.

---

4. True or false: If n is even then the number of even-size subsets of a n-set equals the number of odd-size subsets of an n-set.

True.

---

5. True or false: The Pigeonhole Principle implies that in a class of 100 students there is likely to be two who share a birthday.

False.

Quiz 3

---

1. What is Stirling's Formula?

A. $n! \sim (n/e)^n + \sqrt{2\pi/n}$.

$\rightarrow B$. $n! \sim (n/e)^n \sqrt{2\pi n}$.

C. $n! \sim n^{n/e} \sqrt{2\pi/n}$.

D. All of the above.

E. None of the above.

---

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

$\rightarrow A$. 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.

---

3. True or false: The Pigeonhole Principle implies that in a city the size of New York there are at least two people who have the same number of hairs on their heads.

True.

---

4. True or false: If n is a positive integer then $\displaystyle\sum_{k=0}^{n} (-1)^k \binom{n}{k} = 0$.

True.

---

5. True or false: If n is a positive integer then $\displaystyle\sum_{k=0}^{n} 2^k = 2^{n+1} - 1$.

True.

Quiz 4

---

1. The Binomial Theorem was discovered by

A. Sir Isaac Newton.

→*B*. Omar Khayyam.

C. Blaise Pascal.

D. None of the above.

---

2. True or false: If n is a positive integer then $\displaystyle\sum_{k=0}^{n} \binom{n}{k} = 2^n$.

True.

---

3. True or false: If n is a positive integer then $\displaystyle\sum_{k=0}^{n} (-1)^k \binom{n}{k} = 0$.

True.

---

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 5

---

1. If n is a positive integer then $\sum_{k=0}^{n} \binom{n}{k}^2 =$

$\rightarrow A.$ $\binom{2n}{n}$.

$B.$ $\binom{2n}{n}^2$.

$C.$ $(2n)^n$.

$D.$ None of the above.

---

2. The number of anagrams of the 11-letter word MATHEMATICS is

$A.$ $11!/3!$.

$B.$ $(11!)^2$.

$\rightarrow C.$ $11!/2^3$.

$D.$ None of the above.

---

3. For a fixed positive integer n the binomial coefficients $\binom{2n}{k}$

$A.$ increase for k in the range $[0, n]$.

$B.$ decrease for k in the range $[n, 2n]$.

$C.$ achieve a maximum at $\binom{2n}{n}$.

$\rightarrow D.$ All of the above.

$E.$ None of the above.

---

4. True or false: If n is a positive integer then $\binom{2n}{n} > 2^{2n}$.

False.

---

5. True or false: If n is a positive integer then $\binom{2n}{n} > 2^{2n}/(2n+1)$.

True.

Quiz 6

---

1. True or false: *Recurrence* is to *definition* as *induction* is to *proof*.
True.

---

2. True or false: The Fibonacci sequence is the unique sequence which satisfies the recurrence $F_{n+1} = F_n + F_{n-1}$.
False.

---

3. True or false: The Fibonacci sequence grows approximately exponentially.
True.

---

4. True or false: The ratio of consecutive terms of the Fibonacci sequence approaches a constant in the limit.
True.

---

5. True or false: Fibonacci developed his sequence as part of his solution to a problem in agricultural production in thirteenth century Italy.
False.

Quiz 7

---

1. If k and n are integers and $0 < k < n$ then

$A.$ $\binom{n}{k} + \binom{n}{n-k} = 0.$

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

$\rightarrow C.$ $\binom{n+1}{k+1} = \frac{n+1}{k+1}\binom{n}{k}.$

$D.$ All of the above.

$E.$ None of the above.

---

2. The sum of the first n odd integers is

$\rightarrow A.$ $n^2.$

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

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

$D.$ None of the above.

---

3. The number of anagrams of the word MISSISSIPPI is

$\rightarrow A.$ $\frac{11!}{2! \cdot 4! \cdot 4!}.$

$B.$ $\binom{11}{4}\binom{11}{4}\binom{11}{2}.$

$C.$ $(2! \cdot 4! \cdot 4!)^{11}.$

$D.$ None of the above.

---

4. True or false: If n is a positive integer then $\sum_{k=0}^{n} \binom{n}{k}^2 = \binom{2n}{n}.$

True.

---

5. If F_n is the n-th term of the Fibonacci sequence, $\gamma = \frac{1}{2}(1+\sqrt{5})$, and $\bar{\gamma} = \frac{1}{2}(1-\sqrt{5})$ then

$A.$ $F_{n+1}/F_n \approx \gamma.$

$B.$ $F_n \sim \gamma^n/\sqrt{5}.$

$C.$ $F_n = (\gamma^n - \bar{\gamma}^n)/\sqrt{5}.$

$\rightarrow D.$ All of the above.

$E.$ None of the above.

Quiz 8

---

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

---

2. If A and B are exclusive events then
A. $P(A \cup B) = P(A)P(B)$.
B. $P(A \cap B) = P(A)P(B)$.
$\rightarrow C$. $P(A \cup B) = P(A) + P(B)$.
D. All of the above.
E. None of the above.

---

3. A subset of a sample space is called
A. an outcome.
$\rightarrow B$. an event.
C. a uniform probability.
D. All of the above.
E. None of the above.

---

4. The Law of Small Numbers says that
A. if you look at small examples then you can find many strange or interesting patterns that do no generalize to larger numbers.
B. small numbers exhibit only a small number of patterns, and hence are bound to show us many coincidences.
C. to set up a mathematical conjecture it is not enough to look at some examples and observe some pattern.
$\rightarrow D$. All of the above.
E. None of the above.

---

5. True or false: The Law of Very Large Numbers is a strengthening of the Large of Large Numbers.
False.

Quiz 9

1. True or false: The sample space is the set of all possible outcomes.
True.

2. True or false: In a uniform probability distribution all events have the same probability.
False.

3. True or false: If A and B are events in a probability space S then $P(A \cup B) + P(A \cap B) = P(A) + P(B)$.
True.

4. True or false: The empty set $\emptyset$ is independent of every other event.
True.

5. True or false: If we toss a fair (balanced) coin n times then the probability that we observe exactly k heads is $\binom{n}{k}$.
False.

Quiz 10

---

1. If a and b are positive integers then the expression "$a \mid b$" means

A. the integer value a/b.
B. the statement "a/b is an integer".
C. the integer value b/a.
$\rightarrow D$. the statement "b/a is an integer".
E. None of the above.

---

2. The Prime Number Theorem asserts that the number of primes less than n is asymptotic to

A. $n\ \log(n)$.
$\rightarrow B$. $n/\log(n)$.
C. $n\ \log(n/e)$.
D. None of the above.

---

3. True or false: For any positive integer k there exists an integer a such that there are no primes between a and $a + k$.

True.

---

4. True or false: If p is a prime and a is any integer then $a^p - a$ is a multiple of p.

True.

---

5. True or false: If p is a prime and k is any positive integer less than p then $\binom{p}{k}$ is a multiple of p.

True.

Quiz 11

1. True or false: There does not exist a prime number with exactly 65537 digits.
False.

2. True or false: $\lim_{n\to\infty} \frac{\pi(n)\,\log(n)}{n} = \infty$.
False.

3. True or false: If p is an integer greater than 1 such that $p \mid a^{p-1} - 1$, for every integer a in the range $1, 2, \ldots, p-1$, then p is prime.
True.

4. True or false: If p is an integer greater than 1 such that $p \mid a^{p-1} - 1$, for every integer a such that $\gcd(a, p) = 1$, then p is prime.
False.

5. True or false: If a and b are positive integers then the number of steps Euclid's algorithm requires to compute their gcd is at most the number of binary bits of a plus the number of binary bits of b.
True.

Quiz 12

---

1. If $d = \gcd(a, b)$ then then there are integers m and n such that d can be written in the form

$\rightarrow A.$ $ma + nb$.
$B.$ $a/m + b/n$.
$C.$ $a^m + b^n$.
$D.$ All of the above.
$E.$ None of the above.

---

2. If $a \equiv b \bmod n$ then

$A.$ $a - b$ is a multiple of n.
$B.$ $a \div n$ and $b \div n$ have the same remainder.
$C.$ $a = b + kn$ for some integer k.
$\rightarrow D.$ All of the above.
$E.$ None of the above.

---

3. If $a \equiv b \bmod n$ then

$A.$ for every integer c we have that $\gcd(a, c) = \gcd(b, c)$.
$B.$ for no integer c is it true that $\gcd(a, c) = \gcd(b, c)$.
$\rightarrow C.$ $\gcd(a, n) = \gcd(b, n)$.
$D.$ All of the above.
$E.$ None of the above.

---

4. If $a \equiv b \bmod n$ then

$A.$ for every integer c we have that $a + c \equiv b + c \bmod n$.
$B.$ for every integer c we have that $ac \equiv bc \bmod n$.
$C.$ for every integer c we have that $a - c \equiv b - c \bmod n$.
$\rightarrow D.$ All of the above.
$E.$ None of the above.

---

5. If p is a prime then $\phi(p) =$

$A.$ $1 - \dfrac{1}{p}$.
$B.$ $p + 1$.
$C.$ p.
$\rightarrow D.$ None of the above.

Quiz 13

---

1. True or false: If p and a are any positive integers then $a^p - a$ is a multiple of p.
True.

---

2. True or false: If a and b are positive integers then the number of steps Euclid's algorithm requires to compute their gcd is at most the number of binary bits of ab.
True.

---

3. True or false: If p is an integer greater than 1 such that $p \mid a^{p-1} - 1$, for every integer a such that $\gcd(a, p) = 1$, then p is prime.
False.

---

4. If $a \equiv b \bmod n$ then
A. $a - b$ is a multiple of n.
B. $a \div n$ and $b \div n$ have the same remainder.
C. $a = b + kn$ for some integer k.
→D. All of the above.
E. None of the above.

---

5. $\phi(2^5 \cdot 5^3 \cdot 11^2) =$
A. $3^4 \cdot 6^2 \cdot 11$.
→B. $2^7 \cdot 5^3 \cdot 11$.
C. $2^4 \cdot 5^2 \cdot 11$.
D. None of the above.

Quiz 14

---

1. True or false: For any positive integer k there exists an infinite number of primes greater than k.
True.

---

2. True or false: If p is an integer greater than 1 such that $p \mid a^{p-1} - 1$, for every integer a in the range $1, 2, \ldots, p-1$, then p is prime.
True.

---

3. True or false: If a, b, x, y are integers such that $ax + by = 1$ then $\gcd(a, b) = 1$ and $\gcd(x, y) = 1$.
True.

---

4. $\phi(3^2 \cdot 7^5 \cdot 13^3) =$
$\rightarrow A$. $3 \cdot 7^4 \cdot 13^2 \cdot 2 \cdot 6 \cdot 12$.
B. $2^2 \cdot 6^5 \cdot 12^3 \cdot 3 \cdot 7 \cdot 13$.
C. $3^2 \cdot 2 \cdot 7^5 \cdot 6 \cdot 13^3 \cdot 12$.
D. None of the above.

---

5. The Prime Number Theorem states that
$\rightarrow A$. the density of primes in the interval $[1, n]$ is asymptotic to $1/\log(n)$, as $n \rightarrow +\infty$.
B. the number of primes in the interval $[1, n]$ is approximately $n/\log(n)$, with error tending to 0 as $n \rightarrow +\infty$.
C. the average size of a prime in the interval $[1, n]$ is approximately $1/\log(n)$, with error tending to 0 as $n \rightarrow +\infty$.
D. All of the above.
E. None of the above.

Quiz 15

---

1. A cryptosystem in which each letter is replaced by another is called

A. a one-time pad.
→*B*. a substitution code.
C. cryptology.
D. All of the above.
E. None of the above.

---

2. A disadvantage of a one-time pad is that

→*A*. it requires a long key.
B. it is not secure.
C. it cannot be applied to plain text.
D. All of the above.
E. None of the above.

---

3. Modern cryptography started with the idea that the security of a cryptosystem depends mainly on

A. some secret information required for decryption, called the key.
B. the appropriate use of binary encoding schemes, such as Unicode.
→*C*. the computational complexity of the process of decryption.
D. All of the above.
E. None of the above.

---

4. Suppose Alice's RSA public key is m, e. What is the formula Bob uses to communicate with her?

→*A*. $x^e \bmod m$.
B. $x^e \bmod \phi(m)$.
C. $e^x \bmod \phi(m)$.
D. All of the above.
E. None of the above.

---

5. On what basis has it been proved that RSA is secure?

A. The theorem that prime factorization has complexity NP.
B. The theorem that prime factorization does not have complexity P.
C. Fermat's Theorem that if $\gcd(x, m) = 1$ then $x^{\phi(m)} = x \bmod m$.
D. All of the above.
→*E*. None of the above.

Quiz 16

1. The sum of the degrees of all the nodes in a graph equals

A. the number of edges.

$\rightarrow B$. twice the number of edges.

C. twice the number of nodes.

D. None of the above.

2. The number of nodes of odd degree in a graph must be

A. odd.

$\rightarrow B$. even.

C. either 0 or 2.

D. None of the above.

3. The number of nodes of even degree in a graph must be

A. odd.

B. even

C. either 0 or 2.

$\rightarrow D$. None of the above.

4. A connected graph has an eulerian walk if and only if the number of nodes of odd degree is

A. odd.

B. even.

$\rightarrow C$. either 0 or 2.

D. None of the above.

5. A connected graph has a hamiltonian cycle if and only if the number of nodes of odd degree is

A. odd.

B. even.

C. either 0 or 2.

$\rightarrow D$. None of the above.

Quiz 17

---

1. A graph is a tree if and only if

A. it is connected, but deleting any edge disconnects the graph.
B. it contains no cycle, but adding any edge creates a cycle.
→*C*. All of the above.
D. None of the above.

---

2. Suppose G is a tree with n nodes. How many edges does G have?

A. n.
→*B*. $n - 1$.
C. $\binom{n}{2}$.
D. None of the above.

---

3. The number of labeled trees on n nodes is

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

---

4. True or false: Every connected graph contains a spanning tree.

True.

---

5. True or false: Every tree has a unique labeling.

False.

Quiz 18

---

1. True or false: Kruskal's algorithm always finds a spanning tree that is as cheap as possible.
True.

---

2. True or false: The tree shortcut algorithm always finds a tour that costs less than twice as much as an optimal tour.
False.

---

3. True or false: The problem of whether a given graph has a hamiltonian cycle can be reduced to the traveling salesman problem.
True.

---

4. True or false: There is a bijection between labeled trees on n nodes and binary strings of length n.
False.

---

5. True or false: The number of *un*labeled trees on n nodes is at least 2^n and at most 2^{2n}.
True.

Quiz 19

---

1. True or false: The greedy algorithm always finds the cheapest spanning cycle.
False.

---

2. True or false: The greedy algorithm always finds the cheapest spanning tree.
True.

---

3. True or false: The nodes of a bipartite graph can be partitioned into two disjoint, nonempty sets such that any edge of the graph has one node in each of the parts.
True.

---

4. True or false: If every node of a bipartite graph has the same (positive) degree then the graph contains a perfect matching.
True.

---

5. True or false: If a bipartite graph contains a perfect matching then the greedy algorithm will find a perfect matching.
False.

Quiz 20

---

1. The original SAT was developed in response to
A. the problem of falling academic standards.
B. the problem of low College enrollment.
→*C*. the "Jewish" problem.
D. All of the above.
E. None of the above.

---

2. The original SAT was designed to measure
→*A*. innate ability.
B. mastery of a subject.
C. study habits.
D. All of the above.
E. None of the above.

---

3. Kaplan's success shows that in fact the original SAT more accurately measures
A. innate ability.
B. mastery of a subject.
→*C*. study habits.
D. All of the above.
E. None of the above.

---

4. The University of California study showed that the best predictor of student success in College is
A. the score on SAT I (the aptitude test).
→*B*. the score on SAT II (the subject mastery test).
C. High School GPA.
D. All of the above.
E. None of the above.

---

5. The University of California study showed that the least useful predictor of student success in College is
→*A*. the score on SAT I (the aptitude test).
B. the score on SAT II (the subject mastery test).
C. High School GPA.
D. All of the above.
E. None of the above.

Quiz 21

---

1. Which of the following problems are known to have the "NP" property?

A. Showing that an integer is composite.

B. Showing that a bipartite graph contains a perfect matching.

C. Showing that a graph contains a hamiltonian cycle.

$\rightarrow D$. All of the above.

E. None of the above.

---

2. Which of the following problems are known to be in the class "P"?

$\rightarrow A$. Finding a perfect matching in a bipartite graph.

B. Finding a hamiltonian cycle in a graph.

C. Determining whether a graph contains a hamiltonian cycle.

D. All of the above.

E. None of the above.

---

3. Suppose G, A, B is a bipartite graph with $|A| = |B|$. If G does not contain a perfect matching then

A. there is a subset S of A connected to fewer than $|A|$ nodes in B.

B. there is a subset S of B connected to fewer than $|B|$ nodes in A.

C. not all of the nodes of G have the same degree.

$\rightarrow D$. All of the above.

E. None of the above.

---

4. Suppose G, A, B is a bipartite graph with $|A| = |B|$. If we apply the algorithm in section 10.4 to G then

A. if G has a perfect matching then the algorithm will find one.

B. if G does not have a perfect matching then the algorithm will produce a set of nodes with too few neighbors.

C. the algorithm will only require only "polynomial" running time.

$\rightarrow D$. All of the above.

E. None of the above.

---

5. Suppose G, A, B is a bipartite graph with $|A| = |B|$. If we apply the greedy algorithm to G then

A. if G has a perfect matching then the algorithm will find one.

B. if G does not have a perfect matching then the algorithm will produce a set of nodes with too few neighbors.

$\rightarrow C$. the algorithm will only require only "polynomial" running time.

D. All of the above.

E. None of the above.

Quiz 22

---

1. In a planar map, how many countries are infinite?

A. 0

→*B*. 1

C. Infinitely many.

D. None of the above.

---

2. Euler's Formula $f + v = e + 2$

A. implies that the complete graph K_5 is not planar.

B. implies that a planar map on n nodes has at most $3n - 6$ edges.

C. applies to graphs that can be drawn on the sphere.

→*D*. All of the above.

E. None of the above.

---

3. Suppose G, A, B is a bipartite graph with $|A| = |B|$. If we apply the algorithm in section 10.4 to G then

A. if G has a perfect matching then the algorithm will find one.

B. if G does not have a perfect matching then the algorithm will produce a set of nodes with too few neighbors.

C. the algorithm will only require only "polynomial" running time.

→*D*. All of the above.

E. None of the above.

---

4. True or false: If every node of a bipartite graph has the same (positive) degree then the graph contains a perfect matching.

True.

---

5. True or false: If a bipartite graph contains a perfect matching then the greedy algorithm will find a perfect matching.

False.

Quiz 23

---

1. Under which of the following conditions is a graph G 2-colorable?

A. G is a tree.
B. G is bipartite.
C. Every node in G has degree 1.
$\rightarrow D$. All of the above.
E. None of the above.

---

2. Under which of the following conditions is a graph G 4-colorable?

$\rightarrow A$. G is planar.
B. G is complete.
C. G has a hamiltonian path.
D. All of the above.
E. None of the above.

---

3. True or false: Every planar graph is 3-colorable.

False.

---

4. True or false: There is a relatively easy proof that every planar graph is 4-colorable.

False.

---

5. True or false: There is a relatively easy proof that every planar graph is 5-colorable.

True.

Quiz 24

---

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. What is true in the Fano world that is not true in the Tictactoe world?

A. Any two points lie on a unique line.
→*B*. Any two lines meet in a unique point.
C. The Axiom of Parallels.
D. All of the above.
E. None of the above.

---

5. What is true in the Tictactoe world that is not true in the Fano world?

A. Any two points lie on a unique line.
B. Any two lines meet in a unique point.
→*C*. The Axiom of Parallels.
D. All of the above.
E. None of the above.

Quiz 25

---

1. True or false: If we delete a line and all of its points from a finite projective plane then we obtain a finite affine plane.

True.

---

2. True or false: For every prime power q there is a finite projective plane of order q.

True.

---

3. True or false: In a block design with parameters b, k, v, r, λ every pair of elements is contained in exactly λ blocks.

True.

---

4. What is Fisher's Inequality for a block design with parameters b, k, v, r, λ?

A. $v < k$.
B. $bk < vr$.
→*C*. $b \geq v$.
D. $b \leq r$.
E. $\lambda(v-1) > r(k-1)$.

---

5. What is a Steiner system?

→*A*. A block design with $\lambda = 1$.
B. A block design with $b < v$.
C. A block design with a good 2-coloring.
D. A projective plane of order 10.
E. A pair of orthogonal latin squares.

Quiz 26

---

1. How many errors does repeating a message once detect?

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

---

2. How many errors does repeating a message once correct?

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

---

3. How many errors does the Fano code detect?

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

---

4. How many errors does the Fano code correct?

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

---

5. What code did the NASA Mariner use to send images back from Mars?

  A. A repetition code.
  B. The Fano code.
  C. The Cube code.
→D. A Reed-Müller code.
  E. None of the above.

Quiz 27

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1. Which of the following problems are known to have the "NP" property?
A. Showing that an integer is composite.
B. Showing that a graph contains a hamiltonian cycle.
C. Showing that a bipartite graph contains a perfect matching.
→*D*. All of the above.
E. None of the above.

---

2. Euler's Formula $f + v = e + 2$
A. implies that the complete graph K_5 is not planar.
B. implies that a planar map on n nodes has at most $3n - 6$ edges.
C. applies to graphs that can be drawn on the sphere.
→*D*. All of the above.
E. None of the above.

---

3. Under which of the following conditions is a graph G 5-colorable?
A. G has a hamiltonian path.
B. G is complete.
→*C*. G is planar.
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 Fisher's Inequality for a block design with parameters b, k, v, r, λ?
A. $k > r$.
B. $bk > vr$.
C. $v \leq k$.
→*D*. $v \leq b$.
E. None of the above.