Feedback — Test yourself on preliminary materials

Help Center

You submitted this quiz on **Tue 6 Aug 2013 9:56 PM PDT**. You got a score of **8.00** out of **8.00**.

Dear class,

Do Not Panic!! :-)

This assignment gives you a **friendly** few self-assessment questions on the background material surrounding this class.

Do not worry if some of this material is unfamiliar, or you have already forgotten basic college mathematics. You can pick this up in no time.

We suggest that you use a pencil and paper for this assignment. Feel free to search the internet for answers and do not worry if you did not score too high. It is all good. Best wishes,

Sriram and Shalom

Question 1

What is the minimum value for the function $f(x) = \sin(x^2)$ for $x \in \mathbb{R}$?

1. $\mathbb{R}$ is the set of all real numbers.
2. $\sin(x)$always lies between -1 and $+1$
3. Try this *very cool* link to Wolfram Alpha !

Your Answer		Score	Explanation
-1	✔	2.00	This is the right answer. $\sin(x^2)$ achieves -1 at many points along the real line $x \in \mathbb{R}$

$\frac{1}{3}$	
$-\frac{1}{3}$	
$\frac{\pi}{2}$	
Total	2.00 / 2.00

Question Explanation

Finding the minimum value of a function is a very important part of optimization.

Question 2

Which of the following functions $f(x)$ have *upper bounds* for $x \in \mathbb{R}$?

As an example, the function $f(x) = x^2$ has no upper bound for all $x \in \mathbb{R}$. But the functions $f(x) = \sin(x)$or $f(x) = 1 - x^2$ are both upper bounded.

Your Answer		Score	Explanation
☑ $f(x) = x - \lfloor x \rfloor$	✔	0.17	Upper bound is $f(x) = 1$.
☐ $f(x) = \tan(\frac{x}{2})$	✔	0.17	$\tan(\frac{x}{2})$ "regularly" goes to $+\infty$. So no upper bound exists.
☐ $\log(\lvert x \rvert)$	✔	0.17	As $x \to \infty$, we have $\log(\lvert x \rvert) \to \infty$.
☐ $x^2 - x$	✔	0.17	No upper bound can exist. As $x \to \infty$, the function increases without any bound.

☐ $f(x) = 1 - \log(\log(\lvert x \rvert + 1))$ **Hint:** This one may be evil!! First try asking Wolfram Alpha .	✔	0.17	As you probably found out, as $x \to 0$, $f(x) \to \infty$. Should $f(x)$ have an upper bound? There is no sureshot way of finding this out and intuition is very much a slippery thing!! When in doubt, ask your favorite program to plot the function!!
☑ $f(x) = 17 - x^4$	✔	0.17	Upper bound is $f(x) = 17$ at $x = 0$
Total		1.00 / 1.00	

Question Explanation

A function $f(x)$ is upper bounded if there is a constant K such that $f(x) \leq K$ for all $x \in \mathbb{R}$

Question 3

Which of the matrices below are non-singular, or equivalently invertible?

A square matrix is singular if and only if one of the following conditions hold:

(a) A row (or column) can be written as a linear combination of the other rows (or columns), OR

(b) The determinant of the matrix is zero, OR

(c) It has a non-trivial null space.

You can use MATLAB, Mathematica, or Wolfram Alpha to find out.

Your Answer		Score	Explanation
☐	✔	0.75	The matrix is singular. We can write the second row as a linear combination of the first and third rows.

$A_4 = \begin{pmatrix} 1 & 2 & 2 & -1 \\ 2 & 4 & 4 & -3 \\ 0 & 0 & 0 & 1 \\ 0 & 1 & 1 & 0 \end{pmatrix}$			$R_2 = 2R_1 - R_3$ You can check that its determinant is zero. To find out go to wolfram alpha and type this string below: **det{ { 1,2,2,-1},{2,4,4,-3},{0,0,0,1},{0,1,1,0}}**
☑ $A_3 = \begin{pmatrix} 1 & 1 & 1 \\ 1 & -1 & 1 \\ 1 & 1 & -1 \end{pmatrix}$	✔	0.75	The matrix is not singular, as performing gaussian elimination will reveal. Alternatively, the determinant is 4
☑ $A_2 = \begin{pmatrix} 1 & 0 & 1 \\ 0 & -1 & 0 \\ -1 & 2 & 0 \end{pmatrix}$	✔	0.75	The matrix is not singular. You can convert it into an upper triangular form by Gaussian elimination: $A_2' = \begin{pmatrix} 1 & 0 & 1 \\ 0 & -1 & 0 \\ 0 & 0 & 1 \end{pmatrix}$ Alternatively, the determinant of the matrix is -1
☐ $A_1 = \begin{pmatrix} 1 & 0 & 0 \\ 0 & -1 & 0 \\ -1 & 2 & 0 \end{pmatrix}$	✔	0.75	The matrix is singular. You can see that the third row is a linear combination of the first and second rows: $R_3 = (-1 \times R_1) + (-2 \times R_2)$ Another way of checking is to check that the determinant is zero.
Total		3.00 / 3.00	

Question Explanation

This link gives a useful tutorial for Matlab. For wolfram alpha try this link here

Question 4

Which of the following problems are known to be solvable in polynomial time (efficiently solvable) on a computer?

Note: If this material is new to you, we recommend searching on the web to find the answers.

Your Answer		Score	Explanation
☑ Searching for the shortest path between two nodes in a graph. Hint: Go to google maps first.	✔	0.17	This is efficiently solvable. Or else, google maps may not exist :-)
☐ Factoring a given number into its prime factors. Hint: How can the RSA cryptosystem be broken?	✔	0.17	If this can be solved efficiently, then RSA cryptosystem can be broken.
☑ Solving a Linear Programming Problem (over real-valued variables). Hint: What is this course about?	✔	0.17	Yes, this course will explain why LPs are efficiently solvable.
☑ Checking whether a given number is prime. Hint: Google AKS algorithm. :-)	✔	0.17	Yes. Thanks to some results by Agarwal, Kayal and Saxena (AKS), we finally know that checking primality can be solved in polynomial time.
☐ Deciding whether a given program can halt on a given input. Hint: Search for Alan Turing and his contributions to computer science.	✔	0.17	No. This problem cannot be solved (let alone solved efficiently) using a computer.
☑ Inverting a matrix.	✔	0.17	Gaussian Elimination!
Total		1.00 /	

1.00

Question 5

How many "A"s are there in Sriram's last name?

You entered:

7

Your Answer		Score	Explanation
7	✔	1.00	Yes
Total		1.00 / 1.00	