

The University of Western Ontario

Computer Science 2035b

Solutions for Midterm Examination - Friday, February 27th, 2015

Surname	
Given Name	
Student Number	

This exam consists of 4 questions (8 pages including this page) worth a total of 100%. It is an open book exam, course notes and any MatLab book(s) are allowed. All answers are to be written in this booklet. Scrap work may be done on the back of each page; this will not be marked. No laptops or cell phones are allowed. The exam is 50 minutes long and comprises 20% of your final mark. Please print your full name and student number in the space provided above before you start this exam.

(1) 40%	
(2) 10%	
(3) 30%	
(4) 20%	
Total	

Professor: John Barron

(40%) Consider the following MatLab matrices A, B and C:

```
A= [19  5  6  8;  
    30 22 12 13;  
    28  2  5  9;  
    4  6 24 9];  
B=[3 1; 1 3];  
C=[1; 3];
```

1. (4%) Using the original A above, if $A(1:2,3:4)=\text{eye}(2)$ what is the value of A?
2. (4%) Using the original A above, if $A(3:4,:)=A(:,3:4)'$ what is the value of A?
3. (4%) What is $B*B$:
4. (4%) What is $B.*B$:

5. (4%) What is the value of `[B; C]`?
6. (4%) What is the value of `[C; C]`?
7. (4%) Consider a 4 element column vector `s`. How would you solve the system of equations $A*s=D$, where $D=[1 \ 2 \ 3 \ 4]'$? Do not try to solve this system of equations!!!
8. (4%) What happens when we execute `B*C`?
9. (4%) What happens when we execute `C*B`?
10. (4%) Using the original array `A`, what is the value of `reshape(A,2,8)`?

(2) (10%) This is the Lab question.

1. (3%) Consider the following expression: $6+1^23^45+1^2/3^4*5-6$. Parenthesize this expression according to the precedence of the operators. You do not need to compute its value. What does 1^23^45 evaluate to?

Parenthesized expression:

Value of 1^23^45 :

2. (7%) Draw the graph plotted by:

```
x=[1:10]
y=x.^3;
plot(x,y);
title('y=x^3');
print triple.jpg -djpeg
```

Label the x and y axes and show the title printed.

(3) (30%) This question is loosely related to Assignment 2. Consider the evaluation of a polynomial $p(x) = x^9 + x^6 + x^3 + 1$ for x being a n component column vector `x=linspace(0,1,n)`.

1. (10%) Give the straightforward (brute force) vectorization of this polynomial:
2. (10%) Give the vectorization of this polynomial that does the least number of multiplications.

3. (10%) Consider the following serialized loop that computes the above polynomial:

```
for i=1:n
    x(i)=i;
    p(i)=x(i)^9+x(i)^6+x(i)^3+1;
end
```

Rewrite the original loop so that MatLab's JIT compiler can compile the loop. Improve on the loop efficiency using the ideas in questions (1) and (2).

(4) (20%) Consider the following matrix $Q = \begin{bmatrix} 42 & 0 & -42 \\ 38 & 0 & -38 \\ 19 & 0 & -19 \end{bmatrix}$;

1. (5%) What does `L=Q>-2` print?

2. (5%) What does `C=find(Q>-2)` print? (Hint: `find` returns the coordinates of `Q>-2` as if `Q` were reshaped to be a column vector).

3. (5%) What does `size(Q,2)` print?

4. (5%) What does `sum(L(:))` compute?