MATLAB Exercise 5 – Symbol Computation

1. Compare the following commands, and show the data types and values of a1, a2, a3 and a4.

```
>> a1=1/4+1/6
>> a2=sym(1/4+1/6)
>> a3='1/4+1/6'
>> a4='1/4+1/6'; eval(a4)
```

2. Input following commands, try to compare and analysis the results.

1) a) >> clear; c1= a+2*a; c1

2) a) >> clear; c3='a+2*a'; eval(c3)
   b) >> clear; c4=' a+2*a'; a=3; eval(c4)

3) a) >> clear; syms a; c5=’ a+2*a'; eval(c5)
   b) >> clear; syms a; c6= a+2*a; eval(c6)
   c) >> clear; syms a; c7=sym('a+2*a'); subs(c7, a, 2)
   d) >> clear; syms a; c8=sym('a+2*a'); subs(c8, 2)

4) a) >> clear; c9=sym(' a+2*a+b'); c9
   b) >> clear; c10=sym('a+2*a+b'); subs(c10, 1)
   c) >> clear; c11=sym(' a+2*a+b'); subs(c11, a, 1)
   d) >> clear; syms a; c12=sym('a+2*a+b'); subs(c12,a,1)
   e) >> clear; syms a b; c13=sym('a+2*a+b'); subs(c13,a,1, b,2)
   f) >> clear; syms a b; c14=sym('a+2*a+b'); subs(c14, [a,b], [1, sym('pi')])

3. Let $f = x^3 - 6x^2 + 11x - 6$, $g = (x-1)(x-2)(x-3)$, $h = x[x(x-6)+11]-6$. Please use function factor, horner, expand to prove the following conclusion:

1) f is the expanded form of g and h

2) g is the factor form of f

3) h is the nested form of f

4. Please simply the following functions by using simple, simplify and pretty respectively

1) $\sqrt[3]{\frac{1}{x^3}+\frac{6}{x^2}+\frac{12}{x}+8}$

2) $\cos x + \sqrt{-\sin^2 x}$

3) $\frac{1}{x+1}+\frac{1}{x-1}$

4) $e^{c\ln\sqrt{a+b}}$

5) $\frac{\sin 2\alpha \sin\alpha \cos\alpha}{(1+\cos 4\alpha)(1+\cos\alpha)(1-\cos\alpha)}$

6) $\cos 4\alpha - 4\cos 2\alpha + 3$

Help in command window input help simple (and simplify), understand the effect of these function.

5. Let s express the symbolic expression $a\sin(x)+e^y$. Use subs function to compute the

following expressions, and simply the results.

1) $a\sin(x)+e^{\ln t}$ 2) $a\sin(\frac{\pi}{3})+1$

6. Set $p=a+xy+2xy^2+3x^2y$. Please use collect function to

   1) collects all the coefficients with the same power of x
   2) views p as a polynomial in its symbolic variable y

7. Use randn function to generate a random 2×2 matrix A. Substitute a matrix A into the symbolic expression $3x^2-2x+5$.

8. Set symbolic expression $f(x)=e^{-x}$. Please compute the value of

   1) $f(0)$

   2) $f(eps)$

   3) $f(1), f(2), f(3), ..., f(20)$

9. Generate two symbolic matrices $s\_a=\begin{bmatrix} a & b \\ c & d \end{bmatrix}, s\_b=\begin{bmatrix} u & v \\ s & t \end{bmatrix}$, compute

1) s_a+s_b	2) 2*s_a	3) s_a*s_b
4) s_a.*s_b	5) s_a\s_b	6) s_a/s_b
7) s_c=s_a+i*s_b	8) s_c'	9) s_c .'
10) det(s_a)	11) inv(s_a)	

10. Let a be 2×2 matrix, b be a symbolic matrix $b=\begin{bmatrix} 1 \\ x \end{bmatrix}$. For the following coefficient matrices a, solve the linear equations $ax=b$.

    1) $a=\begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix}$ 2) $a=\begin{bmatrix} 1 & 2 \\ 3 & 6 \end{bmatrix}$ 3) $a=\begin{bmatrix} 1 \\ 2 \end{bmatrix}$

    4) $a=\begin{bmatrix} 1 & 2 \\ 3 & c \end{bmatrix}$ 5) $a=\begin{bmatrix} c & d \\ e & f \end{bmatrix}$ 6) $a=\begin{bmatrix} 1 & 2 & 3 \\ 2 & 3 & 4 \end{bmatrix}$

11. For the following matrix a, compute the eigenvalues and eigenvectors of a.

    1) numeric matrix $a=\begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix}$ 2) symbolic matrix $a=\begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix}$

    3) symbolic matrix $a=\begin{bmatrix} 1 & x \\ 3 & 4 \end{bmatrix}$ 4) symbolic matrix $a=\begin{bmatrix} s & t \\ u & v \end{bmatrix}$

12. For the matrices as Ex11, compute their lu, schur, svd decompositions respectively.