Variant 1. Section A. Problems 1 and 2 out of 8

1. Solve differential equation $y'' + 2y' + y = 2x + 3e^{-x}\sqrt{x+1}$.

2. Given the difference equation $3y_{t+2} + 2y_{t+1} + \gamma y_t = 5$ with the real parameter γ, find all the values of γ for whose the time path of this equation is convergent. Choose some value of γ beyond the found range and show that the corresponding time path is divergent.

Name, group: ....

Variant 1. Section A. Problems 3 and 4 out of 8

3. Find all mixed Nash equilibria of the following game

	d	e	f
a	0;0	0;-1	6;-2
b	0;0	-1;1	7;0
c	-1;5	-1;4	5;9

4. For non-negative y_i minimize the function $11y_1 + 5y_2 + 4y_3 + 4y_4$ subject to constraints $y_1 + y_2 + y_3 + 0.1y_4 \geq 2$ and $2y_1 + y_2 + 0.1y_3 + y_4 \geq 7$.

Name, group:

....

Variant 1. Section A. Problems 5 and 6 out of 8

5. Use the Lagrange multiplier method to find the maximum value of $f(x, y, z) = (7+x)^2(1+y)^2(7+z)^2$ among positive numbers subject to $x^2 + 49y^2 + z^2 = 100$.

6. James Bond added $x^3 + 7x - 8y - 6y^3$ to the unknown homogeneous function $f(x, y)$. The new function was homogeneous once again! Please help the Secret Service agent recover the function f if $f(1, 1) = 1$.

Name, group: ....

Variant 1. Section B. Problems 7 and 8 out of 8

7. Solve initial-value problem for the difference equation

$$y_{t+3} - 4y_{t+2} + 5y_{t+1} - 2y_t = 1$$

with the initial values $y_0 = y_1 = y_2 = 0$.

Hint: one of the characteristic roots is 1.

8. Using Lagrange multipliers maximize the function $f(x_1, x_2, x_3) = 2x_1 - x_2 - 3x_3$ subject to constraints: $3(x_1 - 1)^2 + (x_2 + 1)^2 + 2x_3^2 \leq 4$ and $x_1, x_2, x_3 \geq 0$. Find the point(s) of maximum and maximum value of f.

Name, group:

....

Variant 2. Section A. Problems 1 and 2 out of 8

1. Solve differential equation $y'' - 2y' + y = -x + 3e^x\sqrt{x+1}$.

2. Given the difference equation $5y_{t+2} + 2y_{t+1} + \gamma y_t = 8$ with the real parameter γ, find all the values of γ for whose the time path of this equation is convergent. Choose some value of γ beyond the found range and show that the corresponding time path is divergent.

Name, group: ....

Variant 2. Section A. Problems 3 and 4 out of 8

3. Find all mixed Nash equilibria of the following game

	d	e	f
a	0;0	0;-1	6;-2
b	0;0	-1;2	7;1
c	-1;4	-1;3	5;8

4. For non-negative y_i minimize the function $12y_1 + 5y_2 + 4y_3 + 4y_4$ subject to constraints $y_1 + y_2 + y_3 + 0.1y_4 \geq 2$ and $2y_1 + y_2 + 0.1y_3 + y_4 \geq 5$.

Name, group:

....

Variant 2. Section A. Problems 5 and 6 out of 8

5. Use the Lagrange multiplier method to find the maximum value of $f(x, y, z) = (6+x)^2(1+y)^2(6+z)^2$ among positive numbers subject to $x^2 + 36y^2 + z^2 = 100$.

6. James Bond added $2x^3 + 5x - 6y - 6y^3$ to the unknown homogeneous function $f(x, y)$. The new function was homogeneous once again! Please help the Secret Service agent recover the function f if $f(1, 1) = 1$.

Name, group: ....

Variant 2. Section B. Problems 7 and 8 out of 8

7. Solve initial-value problem for the difference equation

$$y_{t+3} - 4y_{t+2} + 5y_{t+1} - 2y_t = 1$$

   with the initial values $y_0 = y_1 = y_2 = 0$.

   Hint: one of the characteristic roots is 1.

8. Using Lagrange multipliers maximize the function $f(x_1, x_2, x_3) = -3x_1 + 2x_2 - x_3$ subject to constraints: $2x_1^2 + 3(x_2 - 1)^2 + (x_3 + 1)^2 \leq 4$ and $x_1, x_2, x_3 \geq 0$. Find the point(s) of maximum and maximum value of f.

Name, group:
....

Variant 3. Section A. Problems 1 and 2 out of 8

1. Solve differential equation $y'' - 4y' + 4y = x + 3e^{2x}\sqrt{x-1}$.

2. Given the difference equation $3y_{t+2} + 4y_{t+1} + \gamma y_t = 3$ with the real parameter γ, find all the values of γ for whose the time path of this equation is convergent. Choose some value of γ beyond the found range and show that the corresponding time path is divergent.

Name, group: ....

Variant 3. Section A. Problems 3 and 4 out of 8

3. Find all mixed Nash equilibria of the following game

	d	e	f
a	0;0	0;-1	7;-2
b	0;0	-1;3	7;1
c	-1;5	-1;4	5;9

4. For non-negative y_i minimize the function $13y_1 + 5y_2 + 4y_3 + 4y_4$ subject to constraints $y_1 + y_2 + y_3 + 0.1y_4 \geq 2$ and $2y_1 + y_2 + 0.1y_3 + y_4 \geq 4$.

Name, group:

....

Variant 3. Section A. Problems 5 and 6 out of 8

5. Use the Lagrange multiplier method to find the maximum value of $f(x, y, z) = (8+x)^2(1+y)^2(8+z)^2$ among positive numbers subject to $x^2 + 64y^2 + z^2 = 100$.

6. James Bond added $3x^3 + 2x - 3y - 6y^3$ to the unknown homogeneous function $f(x, y)$. The new function was homogeneous once again! Please help the Secret Service agent recover the function f if $f(1, 1) = 1$.

Name, group:

....

Variant 3. Section B. Problems 7 and 8 out of 8

7. Solve initial-value problem for the difference equation

$$y_{t+3} - 4y_{t+2} + 5y_{t+1} - 2y_t = 1$$

with the initial values $y_0 = y_1 = y_2 = 0$.

Hint: one of the characteristic roots is 1.

8. Using Lagrange multipliers maximize the function $f(x_1, x_2, x_3) = -3x_1 - x_2 + 2x_3$ subject to constraints: $2x_1^2 + (x_2 + 1)^2 + 3(x_3 - 1)^2 \leq 4$ and $x_1, x_2, x_3 \geq 0$. Find the point(s) of maximum and maximum value of f.

Name, group:

....

Variant 4. Section A. Problems 1 and 2 out of 8

1. Solve differential equation $y'' + 4y' + 4y = -x + 3e^{-2x}\sqrt{x-2}$.

2. Given the difference equation $5y_{t+2} + 4y_{t+1} + \gamma y_t = 7$ with the real parameter γ, find all the values of γ for whose the time path of this equation is convergent. Choose some value of γ beyond the found range and show that the corresponding time path is divergent.

Name, group:
....

Variant 4. Section A. Problems 3 and 4 out of 8

3. Find all mixed Nash equilibria of the following game

	d	e	f
a	0;0	0;-1	6;-2
b	0;0	-1;4	7;1
c	-1;9	-1;-3	5;8

4. For non-negative y_i minimize the function $14y_1 + 5y_2 + 4y_3 + 4y_4$ subject to constraints $y_1 + y_2 + y_3 + 0.1y_4 \geq 2$ and $2y_1 + y_2 + 0.1y_3 + y_4 \geq 3$.

Name, group:

....

Variant 4. Section A. Problems 5 and 6 out of 8

5. Use the Lagrange multiplier method to find the maximum value of $f(x, y, z) = (9+x)^2(1+y)^2(9+z)^2$ among positive numbers subject to $x^2 + 81y^2 + z^2 = 100$.

6. James Bond added $4x^3 + 2x - 3y - 6y^3$ to the unknown homogeneous function $f(x, y)$. The new function was homogeneous once again! Please help the Secret Service agent recover the function f if $f(1, 1) = 1$.

Name, group: ....

Variant 4. Section B. Problems 7 and 8 out of 8

7. Solve initial-value problem for the difference equation

$$y_{t+3} - 4y_{t+2} + 5y_{t+1} - 2y_t = 1$$

with the initial values $y_0 = y_1 = y_2 = 0$.

Hint: one of the characteristic roots is 1.

8. Using Lagrange multipliers maximize the function $f(x_1, x_2, x_3) = -x_1 - 3x_2 + 2x_3$ subject to constraints: $(x_1 + 1)^2 + 2x_2^2 + 3(x_3 - 1)^2 \leq 4$ and $x_1, x_2, x_3 \geq 0$. Find the point(s) of maximum and maximum value of f.

Name, group:

....