

TABLE I
THE OBJECTIVE FUNCTIONS AND CONSTRAINT FUNCTIONS OF ICD-CMOP1-7.

Problem	Objectives	Constraints
ICD-CMOP1	$\begin{cases} \min & f_1(\mathbf{x}) = (1 + g(\mathbf{x}))x_1 \\ \min & f_2(\mathbf{x}) = (1 + g(\mathbf{x}))(1 - \sqrt{x_1}) \\ \text{where} & g(\mathbf{x}) = 2 \sin(\pi x_1) \sum_{i=2}^n (-0.9t_i^2 + t_i^{0.6}) \\ & t_i = x_i - \sin(0.5\pi x_1) \\ & n = 10, \mathbf{x} \in [0, 1]^n \end{cases}$	$\begin{cases} c_1(\mathbf{x}) = \sin(a\pi x_1) - b \geq 0 \\ c_k(\mathbf{x}) = ((f_1 - p_k)\cos\theta_k - (f_2 - q_k)\sin\theta_k)^2/a_k^2 \\ \quad + ((f_1 - p_k)\sin\theta_k - (f_2 - q_k)\cos\theta_k)^2/b_k^2 \geq r \\ a = 20, b = 0 \\ p_k = [0, 1, 0, 1, 2, 0, 1, 2, 3] \\ q_k = [1.5, 0.5, 2.5, 1.5, 0.5, 3.5, 2.5, 1.5, 0.5] \\ a_k^2 = 0.4, b_k^2 = 1.6, \theta_k = -0.25\pi \\ c = 20, n = 30, x_i \in [0, 1], k = 1, \dots, 9 \end{cases}$
ICD-CMOP2	$\begin{cases} \min & f_1(\mathbf{x}) = (1 + g(\mathbf{x}))x_1 \\ \min & f_2(\mathbf{x}) = (1 + g(\mathbf{x}))(1 - x_1^2) \\ \text{where} & g(\mathbf{x}) = 10 \sin(\pi x_1) \sum_{i=2}^n (\frac{ t_i }{1+e^{5 t_i }}) \\ & t_i = x_i - \sin(0.5\pi x_1) \\ & n = 10, \mathbf{x} \in [0, 1]^n \end{cases}$	They are the same as those of ICD-CMOP1
ICD-CMOP3	$\begin{cases} \min & f_1(\mathbf{x}) = (1 + g(\mathbf{x})) \cos(\frac{\pi x_1}{2}) \\ \min & f_2(\mathbf{x}) = (1 + g(\mathbf{x})) \sin(\frac{\pi x_1}{2}) \\ \text{where} & g(\mathbf{x}) = 10 \sin(\frac{\pi x_1}{2}) \sum_{i=2}^n (\frac{ t_i }{1+e^{5 t_i }}) \\ & t_i = x_i - \sin(0.5\pi x_1) \\ & n = 10, \mathbf{x} \in [0, 1]^n \end{cases}$	They are the same as those of ICD-CMOP1
ICD-CMOP4	$\begin{cases} \min & f_1(\mathbf{x}) = (1 + g(\mathbf{x}))x_1 \\ \min & f_2(\mathbf{x}) = (1 + g(\mathbf{x}))(1 - x_1^{0.5} \cos^2(2\pi x_1)) \\ \text{where} & g(\mathbf{x}) = 1 + 10 \sin(\pi x_1) \sum_{i=2}^n (\frac{ t_i }{1+e^{5 t_i }}) \\ & t_i = x_i - \sin(0.5\pi x_1) \\ & n = 10, \mathbf{x} \in [0, 1]^n \end{cases}$	They are the same as those of ICD-CMOP1
ICD-CMOP5	$\begin{cases} \min & f_1(\mathbf{x}) = (1 + g(\mathbf{x}))x_1 \\ \min & f_2(\mathbf{x}) = (1 + g(\mathbf{x}))(1 - \sqrt{x_1}) \\ \text{where} & g(\mathbf{x}) = 2 \cos(\pi x_1) \sum_{i=2}^n (-0.9t_i^2 + t_i^{0.6}) \\ & t_i = x_i - \sin(0.5\pi x_1) \\ & n = 10, \mathbf{x} \in [0, 1]^n \end{cases}$	They are the same as those of ICD-CMOP1
ICD-CMOP6	$\begin{cases} \min & f_1(\mathbf{x}) = (1 + g(\mathbf{x}))x_1x_2 \\ \min & f_2(\mathbf{x}) = (1 + g(\mathbf{x}))x_1(1 - x_2) \\ \min & f_3(\mathbf{x}) = (1 + g(\mathbf{x}))(1 - x_1) \\ \text{where} & g(\mathbf{x}) = 2 \sin(\pi x_1) \sum_{i=3}^n (-0.9t_i^2 + t_i^{0.6}) \\ & t_i = x_i - x_1x_2 \\ & n = 10, \mathbf{x} \in [0, 1]^n \end{cases}$	$\begin{cases} c_1(\mathbf{x}) = \sin(a\pi x_1) - b \geq 0 \\ c_2(\mathbf{x}) = \cos(a\pi x_2) - b \geq 0 \\ c_k(\mathbf{x}) = ((f_1 - p_k)\cos\theta_k - (f_2 - q_k)\sin\theta_k)^2/a_k^2 \\ \quad + ((f_1 - p_k)\sin\theta_k - (f_2 - q_k)\cos\theta_k)^2/b_k^2 \geq r \\ a = 20, b = 0 \\ p_k = [0, 1, 0, 1, 2, 0, 1, 2, 3] \\ q_k = [1.5, 0.5, 2.5, 1.5, 0.5, 3.5, 2.5, 1.5, 0.5] \\ a_k^2 = 0.4, b_k^2 = 1.6, \theta_k = -0.25\pi \\ c = 20, n = 30, x_i \in [0, 1], k = 1, \dots, 9 \end{cases}$
ICD-CMOP7	$\begin{cases} \min & f_1(\mathbf{x}) = (1 + g(\mathbf{x})) \cos(\frac{x_1\pi}{2}) \cos(\frac{x_2\pi}{2}) \\ \min & f_2(\mathbf{x}) = (1 + g(\mathbf{x})) \cos(\frac{x_1\pi}{2}) \sin(\frac{x_2\pi}{2}) \\ \min & f_3(\mathbf{x}) = (1 + g(\mathbf{x})) \sin(\frac{x_2\pi}{2}) \\ \text{where} & g(\mathbf{x}) = 2 \sin(\pi x_1) \sum_{i=3}^n (-0.9t_i^2 + t_i^{0.6}) \\ & t_i = x_i - x_1x_2 \\ & n = 10, \mathbf{x} \in [0, 1]^n \end{cases}$	They are the same as those of ICD-CMOP6