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A new multivariate EWMA scheme for monitoring covariance matrices

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1. Supplementary

In the paper, we have only shown a part of the simulation results. The complete records are listed in the following tables.

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Table 1. ARL_1 (STD) comparison between the HMT chart and the MaxNorm chart for Σ_{OC_j} , $j \in \{1, 2, 3, 4\}$, when $n = 1$.

	$\Delta/\sqrt{n_t}$	$p = 5$		$p = 10$		$p = 30$	
		HMT	MaxNorm	HMT	MaxNorm	HMT	MaxNorm
Σ_{OC_1}	0.80	31.3 (26.0)	18.5 (15.4)	46.5 (37.7)	21.0 (16.9)	94.6 (67.4)	24.9 (18.4)
	1.60	18.2 (13.9)	11.7 (9.03)	27.4 (19.6)	12.8 (9.38)	66.4 (42.4)	15.5 (10.1)
	2.40	13.5 (9.69)	9.11 (7.08)	20.0 (13.0)	9.73 (6.82)	51.4 (28.5)	11.6 (6.90)
	3.20	11.1 (7.84)	7.32 (5.52)	16.0 (10.1)	7.89 (5.52)	42.9 (21.5)	9.58 (5.38)
	4.00	9.49 (6.63)	6.23 (4.72)	13.6 (7.76)	6.80 (4.59)	37.2 (17.1)	8.24 (4.52)
	4.80	8.23 (5.60)	5.67 (4.38)	12.0 (6.59)	6.05 (4.14)	33.0 (13.4)	7.29 (3.81)
	5.60	7.41 (5.00)	5.09 (3.92)	10.6 (5.66)	5.44 (3.68)	29.8 (11.0)	6.58 (3.41)
	6.40	6.79 (4.63)	4.69 (3.62)	9.74 (5.05)	4.97 (3.33)	27.8 (9.41)	6.00 (3.15)
	7.20	6.24 (4.26)	4.35 (3.39)	8.95 (4.60)	4.51 (3.08)	25.7 (7.84)	5.62 (2.90)
	8.00	5.82 (3.90)	3.98 (3.09)	8.32 (4.09)	4.24 (2.90)	24.3 (6.94)	5.14 (2.63)
Σ_{OC_2}	0.80	43.2 (35.3)	27.0 (23.5)	71.8 (58.8)	33.0 (28.4)	137 (101)	45.0 (39.6)
	1.60	27.8 (21.0)	17.4 (14.5)	48.1 (35.5)	21.1 (17.4)	110 (77.0)	26.8 (22.2)
	2.40	22.0 (16.2)	13.6 (11.2)	37.9 (25.7)	15.9 (12.8)	93.8 (59.7)	20.1 (16.1)
	3.20	18.4 (13.4)	11.4 (9.46)	32.2 (21.2)	13.5 (10.9)	82.7 (50.3)	16.6 (13.0)
	4.00	16.1 (11.4)	10.1 (8.29)	27.9 (17.4)	11.9 (9.62)	75.3 (43.4)	14.2 (11.2)
	4.80	14.4 (10.3)	9.24 (7.64)	25.4 (15.6)	10.5 (8.37)	70.1 (38.0)	12.7 (10.0)
	5.60	13.4 (9.30)	8.39 (6.92)	23.1 (13.7)	9.63 (7.87)	64.6 (33.8)	11.6 (9.08)
	6.40	12.2 (8.46)	7.70 (6.32)	21.7 (12.9)	8.94 (7.15)	61.2 (31.1)	10.6 (8.43)
	7.20	11.5 (7.88)	7.30 (6.04)	20.1 (11.7)	8.37 (6.63)	57.9 (28.1)	9.81 (7.70)
	8.00	10.9 (7.58)	6.88 (5.77)	19.0 (10.9)	7.88 (6.37)	56.0 (26.4)	9.24 (7.44)
Σ_{OC_3}	0.80	49.0 (36.7)	79.9 (74.5)	78.9 (59.8)	117 (110)	141 (104)	176 (168)
	1.60	29.5 (19.2)	48.8 (42.8)	50.4 (33.4)	77.7 (71.5)	110 (72.5)	155 (147)
	2.40	22.0 (13.0)	36.2 (30.7)	38.2 (21.8)	58.4 (49.8)	90.7 (55.2)	131 (123)
	3.20	18.4 (9.87)	29.6 (24.0)	31.2 (16.1)	46.6 (39.6)	77.4 (40.8)	116 (107)
	4.00	15.9 (8.06)	24.8 (19.6)	27.0 (12.5)	39.3 (32.7)	68.8 (33.4)	102 (91.8)
	4.80	14.3 (7.01)	22.1 (17.3)	24.0 (10.5)	34.1 (27.9)	61.7 (26.9)	89.4 (80.3)
	5.60	12.9 (6.02)	19.6 (15.2)	21.9 (8.96)	30.6 (24.4)	56.7 (23.3)	81.5 (72.4)
	6.40	11.9 (5.43)	17.9 (13.5)	20.4 (7.71)	27.4 (21.4)	52.7 (19.2)	72.6 (64.5)
	7.20	11.1 (4.85)	16.7 (12.4)	18.8 (6.69)	25.1 (19.1)	49.6 (17.1)	66.0 (54.9)
	8.00	10.3 (4.44)	15.6 (11.2)	17.8 (6.05)	23.4 (18.0)	46.7 (14.4)	60.7 (51.7)
Σ_{OC_4}	0.80	34.9 (20.4)	87.9 (81.0)	58.8 (38.3)	121 (113)	118 (80.4)	171 (164)
	1.60	17.8 (5.66)	50.6 (42.9)	28.5 (9.27)	70.1 (60.0)	67.4 (29.1)	109 (99.1)
	2.40	13.8 (3.98)	31.0 (24.4)	21.6 (5.00)	42.0 (33.6)	47.0 (8.94)	63.7 (53.1)
	3.20	12.4 (4.21)	21.1 (16.2)	19.9 (5.27)	28.0 (21.0)	45.2 (8.84)	41.5 (32.6)
	4.00	11.1 (4.27)	15.7 (12.1)	18.2 (5.29)	20.9 (15.4)	43.3 (8.56)	30.4 (22.8)
	4.80	10.1 (4.33)	12.1 (9.34)	16.7 (5.34)	16.1 (12.3)	41.6 (8.40)	22.4 (17.6)
	5.60	9.12 (4.27)	9.97 (7.67)	15.4 (5.31)	12.6 (9.87)	39.8 (8.11)	16.2 (12.8)
	6.40	8.26 (4.13)	8.33 (6.45)	14.2 (5.20)	10.2 (8.16)	38.1 (7.84)	12.8 (9.90)
	7.20	7.60 (4.06)	7.09 (5.66)	13.2 (5.08)	8.52 (6.81)	36.6 (7.68)	10.2 (8.07)
	8.00	6.91 (3.87)	6.18 (4.98)	12.3 (4.92)	7.27 (5.74)	35.2 (7.51)	8.54 (6.68)

Table 2. ARL_1 (STD) comparison between the HMT chart and the MaxNorm chart for Σ_{OC_j} , $j \in \{5, 6, 7\}$, when $n = 1$.

	$\Delta/\sqrt{n_t}$	$p = 5$		$p = 10$		$p = 30$	
		HMT	MaxNorm	HMT	MaxNorm	HMT	MaxNorm
Σ_{OC_5}	0.80	42.8 (35.1)	36.0 (31.6)	71.8 (56.7)	50.7 (45.5)	135 (98.5)	85.9 (80.2)
	1.60	27.5 (20.6)	23.0 (19.7)	48.7 (35.2)	32.2 (27.1)	110 (76.6)	57.0 (49.6)
	2.40	21.7 (16.5)	18.0 (14.8)	37.6 (25.6)	25.3 (20.1)	93.2 (59.4)	43.7 (37.6)
	3.20	18.2 (13.3)	15.1 (12.2)	31.9 (21.0)	20.7 (16.6)	83.4 (51.0)	35.4 (29.0)
	4.00	16.0 (11.4)	13.3 (10.6)	28.0 (17.7)	18.0 (14.4)	76.0 (43.4)	30.5 (25.1)
	4.80	14.5 (10.1)	11.9 (9.46)	25.3 (15.6)	16.1 (12.4)	69.6 (38.7)	27.1 (21.9)
	5.60	13.4 (9.30)	10.8 (8.64)	23.0 (13.5)	14.8 (11.4)	64.8 (34.0)	23.8 (18.7)
	6.40	12.3 (8.55)	10.1 (8.08)	21.4 (12.6)	13.6 (10.3)	61.1 (31.0)	22.2 (17.1)
	7.20	11.7 (8.27)	9.56 (7.64)	20.0 (11.5)	12.6 (9.64)	58.1 (28.2)	20.3 (15.7)
	8.00	10.8 (7.41)	8.91 (7.09)	19.1 (10.9)	12.0 (8.99)	55.8 (25.1)	18.9 (14.6)
Σ_{OC_6}	0.80	44.5 (35.3)	44.0 (39.3)	72.8 (56.6)	63.5 (58.2)	136 (102)	102 (95.0)
	1.60	28.7 (21.1)	25.3 (21.4)	49.2 (35.4)	35.5 (29.9)	110 (74.7)	56.4 (49.6)
	2.40	22.2 (16.1)	18.5 (15.6)	38.5 (26.0)	25.0 (20.9)	95.0 (60.8)	38.9 (32.7)
	3.20	18.5 (13.0)	14.5 (11.8)	31.9 (20.9)	19.4 (15.6)	84.3 (52.5)	29.3 (24.5)
	4.00	16.2 (11.4)	12.5 (9.97)	27.9 (17.4)	16.3 (12.7)	75.2 (43.3)	23.2 (18.1)
	4.80	14.6 (10.4)	10.9 (8.73)	25.2 (15.6)	14.3 (11.1)	70.1 (38.9)	19.8 (15.8)
	5.60	13.1 (9.19)	9.68 (7.78)	22.7 (13.4)	12.7 (9.87)	64.8 (34.1)	17.2 (13.3)
	6.40	12.0 (8.36)	8.82 (7.05)	21.1 (12.3)	11.2 (8.69)	60.5 (30.6)	15.2 (11.8)
	7.20	11.1 (7.83)	8.20 (6.50)	19.6 (11.3)	10.3 (7.98)	57.7 (28.2)	13.9 (10.8)
	8.00	10.4 (7.26)	7.52 (5.97)	18.4 (10.7)	9.52 (7.33)	54.5 (25.1)	12.5 (9.51)
Σ_{OC_7}	0.80	37.7 (30.4)	28.1 (23.9)	65.2 (51.3)	39.4 (34.3)	129 (94.7)	68.2 (61.4)
	1.60	23.7 (17.7)	17.8 (14.6)	41.6 (29.1)	25.2 (20.6)	101 (67.0)	43.6 (37.0)
	2.40	18.1 (12.9)	13.8 (10.9)	32.0 (21.1)	19.3 (14.9)	84.7 (51.8)	32.5 (26.4)
	3.20	14.8 (10.2)	11.6 (9.13)	26.8 (16.7)	15.7 (11.9)	75.0 (43.3)	26.4 (21.2)
	4.00	13.0 (8.82)	10.1 (7.84)	23.3 (13.6)	13.8 (10.5)	67.3 (35.8)	22.1 (17.1)
	4.80	11.5 (7.71)	9.03 (6.93)	20.9 (12.2)	12.1 (9.09)	62.1 (32.2)	19.6 (14.7)
	5.60	10.6 (7.00)	8.12 (6.27)	19.1 (10.6)	11.2 (8.31)	57.3 (27.4)	17.5 (13.2)
	6.40	9.67 (6.48)	7.58 (5.90)	17.6 (9.60)	10.4 (7.60)	53.8 (24.8)	15.9 (11.9)
	7.20	9.03 (6.01)	6.99 (5.52)	16.5 (8.87)	9.35 (6.83)	51.4 (23.1)	14.6 (10.7)
	8.00	8.42 (5.57)	6.55 (5.15)	15.5 (8.19)	8.79 (6.35)	48.8 (21.0)	13.9 (10.0)

Table 3. ARL_1 (STD) comparison between the HMT chart and the MaxNorm chart for Σ_{OC_j} , $j \in \{1, 2, 3, 4\}$, when $n = 20$.

	$\Delta/\sqrt{n_t}$	$p = 5$		$p = 10$		$p = 30$	
		HMT	MaxNorm	HMT	MaxNorm	HMT	MaxNorm
Σ_{OC_1}	0.80	11.1 (5.31)	13.8 (8.05)	17.1 (8.43)	19.4 (12.0)	41.1 (26.8)	27.9 (17.1)
	1.60	6.82 (2.75)	7.47 (3.55)	10.3 (3.80)	10.1 (4.65)	22.2 (10.0)	15.1 (6.47)
	2.40	5.19 (1.95)	5.38 (2.31)	7.79 (2.55)	7.21 (2.86)	16.4 (5.80)	11.1 (3.80)
	3.20	4.33 (1.56)	4.33 (1.80)	6.46 (1.94)	5.83 (2.16)	13.3 (3.86)	9.09 (2.84)
	4.00	3.73 (1.33)	3.68 (1.49)	5.61 (1.61)	5.00 (1.73)	11.6 (2.97)	7.83 (2.26)
	4.80	3.31 (1.17)	3.23 (1.31)	4.98 (1.38)	4.34 (1.50)	10.3 (2.33)	6.96 (1.90)
	5.60	2.97 (1.05)	2.86 (1.15)	4.53 (1.24)	3.92 (1.32)	9.45 (2.02)	6.39 (1.69)
	6.40	2.73 (0.97)	2.61 (1.06)	4.18 (1.13)	3.55 (1.17)	8.71 (1.73)	5.87 (1.50)
	7.20	2.51 (0.90)	2.38 (0.96)	3.87 (1.02)	3.30 (1.08)	8.10 (1.52)	12.5 (1.38)
	8.00	2.33 (0.85)	2.19 (0.89)	3.61 (0.96)	3.03 (1.00)	7.67 (1.38)	6.89 (1.27)
Σ_{OC_2}	0.80	13.0 (6.68)	10.2 (10.2)	21.1 (11.2)	11.1 (6.34)	55.6 (37.3)	12.5 (7.15)
	1.60	8.04 (3.46)	5.90 (5.90)	12.9 (5.25)	6.30 (3.30)	32.2 (16.9)	6.89 (3.58)
	2.40	6.26 (2.53)	4.38 (4.38)	10.0 (3.63)	4.64 (2.40)	24.2 (10.1)	5.08 (2.54)
	3.20	5.18 (2.08)	3.57 (3.57)	8.41 (2.80)	3.76 (1.93)	20.1 (7.15)	4.05 (2.00)
	4.00	4.51 (1.78)	3.01 (3.01)	7.35 (2.36)	3.18 (1.62)	17.5 (5.55)	3.48 (1.75)
	4.80	4.02 (1.59)	2.64 (2.64)	6.63 (2.07)	2.81 (1.49)	15.9 (4.53)	3.05 (1.56)
	5.60	3.65 (1.45)	2.35 (2.35)	6.11 (1.89)	2.50 (1.33)	14.6 (3.86)	2.72 (1.38)
	6.40	3.38 (1.36)	2.15 (2.15)	5.65 (1.74)	2.28 (1.22)	13.5 (3.36)	2.47 (1.26)
	7.20	3.15 (1.27)	2.00 (2.00)	5.28 (1.60)	2.09 (1.15)	12.8 (3.03)	2.30 (1.20)
	8.00	2.96 (1.19)	1.83 (1.83)	4.98 (1.50)	1.92 (1.07)	12.1 (2.76)	2.12 (1.13)
Σ_{OC_3}	0.80	12.8 (5.86)	15.2 (6.38)	20.6 (9.69)	29.5 (15.7)	53.8 (35.8)	73.5 (54.8)
	1.60	7.96 (3.00)	8.46 (2.70)	12.7 (4.57)	16.1 (6.06)	30.9 (14.7)	36.8 (19.6)
	2.40	6.14 (2.15)	6.18 (1.81)	9.83 (3.05)	12.0 (3.71)	22.9 (8.31)	25.1 (10.1)
	3.20	5.17 (1.72)	4.97 (1.40)	8.29 (2.34)	9.84 (2.91)	18.9 (5.58)	19.7 (6.72)
	4.00	4.47 (1.44)	4.22 (1.17)	7.28 (1.92)	8.52 (2.36)	16.6 (4.23)	16.6 (5.13)
	4.80	4.00 (1.29)	3.73 (1.01)	6.54 (1.66)	7.58 (2.02)	15.0 (3.54)	14.6 (4.15)
	5.60	3.64 (1.17)	3.34 (0.92)	6.01 (1.47)	6.90 (1.81)	13.8 (2.92)	13.2 (3.60)
	6.40	3.36 (1.08)	3.03 (0.84)	5.58 (1.37)	6.38 (1.61)	12.9 (2.53)	12.1 (3.12)
	7.20	3.14 (1.01)	2.79 (0.78)	5.22 (1.28)	5.96 (1.49)	12.2 (2.28)	11.2 (2.84)
	8.00	2.94 (0.96)	2.58 (0.74)	4.91 (1.18)	5.58 (1.40)	11.5 (2.02)	10.5 (2.66)
Σ_{OC_4}	0.80	11.4 (4.44)	15.2 (6.38)	18.3 (7.50)	17.7 (7.75)	45.9 (28.0)	21.5 (10.4)
	1.60	7.05 (2.03)	8.46 (2.70)	11.0 (3.01)	9.26 (3.11)	24.9 (9.04)	10.4 (3.55)
	2.40	5.35 (1.33)	6.18 (1.81)	8.44 (1.87)	6.64 (2.00)	18.4 (4.71)	7.40 (2.19)
	3.20	4.49 (1.06)	4.97 (1.40)	7.08 (1.37)	5.34 (1.54)	15.2 (2.97)	5.89 (1.65)
	4.00	3.90 (0.87)	4.22 (1.17)	6.21 (1.10)	4.52 (1.25)	13.2 (2.09)	4.99 (1.36)
	4.80	3.46 (0.77)	3.73 (1.01)	5.56 (0.94)	3.95 (1.08)	11.9 (1.64)	4.33 (1.15)
	5.60	3.14 (0.70)	3.34 (0.92)	5.08 (0.83)	3.54 (0.97)	10.9 (1.30)	3.89 (1.02)
	6.40	2.89 (0.64)	3.03 (0.84)	4.70 (0.74)	3.22 (0.89)	10.2 (1.13)	3.56 (0.92)
	7.20	2.68 (0.59)	2.79 (0.78)	4.41 (0.70)	2.96 (0.83)	9.56 (0.98)	3.24 (0.87)
	8.00	2.53 (0.57)	2.58 (0.74)	4.13 (0.65)	2.75 (0.77)	9.06 (0.87)	3.01 (0.80)

Table 4. ARL_1 (STD) comparison between the HMT chart and the MaxNorm chart for Σ_{OC_j} , $j \in \{5, 6, 7\}$, when $n = 20$.

	$\Delta/\sqrt{n_t}$	$p = 5$		$p = 10$		$p = 30$	
		HMT	MaxNorm	HMT	MaxNorm	HMT	MaxNorm
Σ_{OC_5}	0.80	13.0 (6.57)	18.1 (10.6)	21.0 (10.8)	24.7 (14.6)	55.7 (38.4)	41.0 (27.3)
	1.60	8.00 (3.48)	10.2 (4.87)	12.9 (5.23)	13.6 (6.24)	32.6 (17.1)	20.6 (10.6)
	2.40	6.20 (2.52)	7.47 (3.36)	10.0 (3.64)	9.94 (4.18)	24.3 (9.98)	14.5 (6.58)
	3.20	5.17 (2.07)	6.09 (2.61)	8.39 (2.81)	8.15 (3.24)	20.1 (7.12)	11.4 (4.85)
	4.00	4.53 (1.78)	5.20 (2.18)	7.40 (2.39)	7.02 (2.64)	17.6 (5.64)	9.61 (4.01)
	4.80	4.05 (1.61)	4.59 (1.92)	6.61 (2.08)	6.21 (2.32)	15.9 (4.60)	8.36 (3.38)
	5.60	3.69 (1.49)	4.14 (1.72)	6.08 (1.89)	5.61 (2.08)	14.5 (3.86)	7.51 (3.01)
	6.40	3.38 (1.37)	3.74 (1.57)	5.64 (1.72)	5.18 (1.92)	13.6 (3.46)	6.78 (2.65)
	7.20	3.16 (1.27)	3.52 (1.48)	5.25 (1.61)	4.83 (1.77)	12.8 (3.02)	6.28 (2.47)
	8.00	2.96 (1.21)	3.25 (1.38)	4.98 (1.51)	4.47 (1.66)	12.2 (2.76)	5.80 (2.28)
Σ_{OC_6}	0.80	12.2 (5.46)	16.5 (8.05)	19.7 (9.28)	19.0 (9.29)	51.5 (33.6)	23.2 (12.0)
	1.60	7.81 (3.02)	9.27 (3.73)	12.4 (4.48)	10.4 (4.08)	30.1 (14.5)	11.8 (4.69)
	2.40	6.12 (2.25)	7.02 (2.63)	9.75 (3.14)	7.77 (2.89)	23.1 (8.85)	8.74 (3.19)
	3.20	5.12 (1.88)	5.75 (2.18)	8.25 (2.57)	6.40 (2.34)	19.4 (6.28)	7.12 (2.51)
	4.00	4.48 (1.67)	4.96 (1.86)	7.32 (2.17)	5.56 (2.01)	17.1 (5.11)	6.15 (2.21)
	4.80	4.04 (1.52)	4.40 (1.68)	6.57 (1.92)	5.00 (1.82)	15.5 (4.19)	5.54 (1.98)
	5.60	3.66 (1.39)	4.02 (1.58)	6.08 (1.82)	4.55 (1.68)	14.4 (3.56)	4.98 (1.78)
	6.40	3.38 (1.31)	3.66 (1.46)	5.65 (1.67)	4.19 (1.59)	13.6 (3.27)	4.64 (1.70)
	7.20	3.14 (1.23)	3.39 (1.38)	5.30 (1.55)	3.91 (1.49)	12.7 (2.92)	4.31 (1.60)
	8.00	2.96 (1.16)	3.14 (1.30)	4.96 (1.47)	3.66 (1.41)	12.1 (2.66)	4.03 (1.52)
Σ_{OC_7}	0.80	12.0 (5.84)	17.3 (10.4)	19.8 (9.83)	22.7 (13.5)	51.5 (34.7)	34.3 (22.0)
	1.60	7.43 (3.02)	9.31 (4.43)	12.0 (4.64)	12.2 (5.56)	29.9 (14.6)	17.6 (8.51)
	2.40	5.76 (2.23)	6.80 (3.00)	9.26 (3.13)	8.97 (3.64)	22.2 (8.68)	12.5 (5.41)
	3.20	4.77 (1.78)	5.52 (2.28)	7.75 (2.43)	7.26 (2.73)	18.5 (6.14)	9.83 (4.10)
	4.00	4.17 (1.54)	4.68 (1.89)	6.77 (2.03)	6.24 (2.31)	16.1 (4.67)	8.34 (3.38)
	4.80	3.71 (1.37)	4.11 (1.63)	6.10 (1.77)	5.53 (1.99)	14.5 (3.74)	7.21 (2.86)
	5.60	3.38 (1.26)	3.71 (1.48)	5.58 (1.57)	5.02 (1.81)	13.3 (3.16)	6.47 (2.53)
	6.40	3.07 (1.14)	3.38 (1.34)	5.17 (1.45)	4.56 (1.64)	12.4 (2.82)	5.88 (2.29)
	7.20	2.86 (1.07)	3.10 (1.23)	4.81 (1.33)	4.24 (1.52)	11.7 (2.47)	5.36 (2.06)
	8.00	2.67 (1.00)	2.88 (1.15)	4.54 (1.27)	3.95 (1.40)	11.1 (2.30)	4.97 (1.91)

Table 5. ARL_1 (STD) comparison between the HMT chart and the MaxNorm chart for Σ_{OC_j} , $j \in \{1, 2, 3, 4\}$, when $n = 50$.

	$\Delta/\sqrt{n_t}$	$p = 5$		$p = 10$		$p = 30$	
		HMT	MaxNorm	HMT	MaxNorm	HMT	MaxNorm
Σ_{OC_1}	0.80	7.96 (3.06)	7.69 (3.31)	12.2 (4.58)	10.9 (4.60)	28.0 (14.1)	18.4 (8.44)
	1.60	4.98 (1.65)	4.68 (1.71)	7.67 (2.21)	6.54 (2.16)	16.2 (5.13)	11.1 (3.57)
	2.40	3.88 (1.20)	3.51 (1.22)	5.92 (1.49)	4.95 (1.48)	12.4 (2.97)	8.58 (2.38)
	3.20	3.19 (0.96)	2.89 (0.98)	4.96 (1.17)	4.10 (1.17)	10.4 (2.09)	7.21 (1.82)
	4.00	2.77 (0.84)	2.47 (0.85)	4.34 (1.01)	3.55 (0.98)	9.19 (1.67)	6.36 (1.52)
	4.80	2.43 (0.74)	2.17 (0.75)	3.87 (0.87)	3.15 (0.86)	8.30 (1.39)	5.70 (1.32)
	5.60	2.21 (0.68)	1.94 (0.68)	3.52 (0.79)	2.85 (0.78)	7.62 (1.19)	5.23 (1.22)
	6.40	2.02 (0.63)	1.76 (0.64)	3.26 (0.72)	2.61 (0.73)	7.08 (1.06)	4.85 (1.07)
	7.20	1.86 (0.61)	1.61 (0.60)	3.01 (0.68)	2.42 (0.66)	6.64 (0.96)	4.53 (1.02)
	8.00	1.73 (0.59)	1.49 (0.57)	2.83 (0.64)	2.25 (0.62)	6.28 (0.88)	4.28 (0.93)
Σ_{OC_2}	0.80	8.72 (3.53)	6.10 (2.95)	14.1 (5.61)	6.52 (3.14)	34.5 (18.4)	7.27 (3.41)
	1.60	5.58 (1.99)	3.65 (1.68)	8.94 (2.81)	3.91 (1.73)	20.7 (7.63)	4.31 (1.83)
	2.40	4.30 (1.46)	2.72 (1.24)	7.02 (1.98)	2.91 (1.30)	16.1 (4.58)	3.18 (1.36)
	3.20	3.63 (1.20)	2.20 (1.04)	5.91 (1.59)	2.36 (1.07)	13.7 (3.33)	2.62 (1.12)
	4.00	3.16 (1.07)	1.87 (0.89)	5.23 (1.35)	2.00 (0.93)	12.2 (2.60)	2.23 (0.98)
	4.80	2.81 (0.95)	1.63 (0.81)	4.72 (1.19)	1.75 (0.83)	11.1 (2.19)	1.93 (0.85)
	5.60	2.56 (0.88)	1.46 (0.73)	4.31 (1.08)	1.56 (0.75)	10.3 (1.90)	1.73 (0.79)
	6.40	2.35 (0.81)	1.32 (0.69)	3.99 (1.01)	1.41 (0.70)	9.65 (1.70)	1.57 (0.75)
	7.20	2.17 (0.79)	1.20 (0.66)	3.73 (0.95)	1.28 (0.66)	9.11 (1.55)	1.44 (0.69)
	8.00	2.02 (0.73)	1.11 (0.62)	3.51 (0.90)	1.17 (0.63)	8.68 (1.45)	1.31 (0.64)
Σ_{OC_3}	0.80	8.69 (3.23)	11.9 (4.51)	13.8 (5.06)	18.2 (7.45)	33.8 (17.4)	47.4 (29.7)
	1.60	5.56 (1.76)	7.25 (2.22)	8.86 (2.45)	10.7 (3.14)	20.2 (6.70)	22.8 (8.80)
	2.40	4.32 (1.30)	5.56 (1.56)	6.95 (1.73)	8.17 (2.07)	15.7 (3.94)	16.3 (4.79)
	3.20	3.62 (1.06)	4.61 (1.24)	5.91 (1.37)	6.84 (1.61)	13.3 (2.78)	13.1 (3.40)
	4.00	3.15 (0.92)	3.98 (1.06)	5.18 (1.14)	5.96 (1.35)	11.8 (2.15)	11.2 (2.64)
	4.80	2.81 (0.82)	3.55 (0.94)	4.68 (1.01)	5.34 (1.18)	10.8 (1.82)	9.92 (2.24)
	5.60	2.56 (0.76)	3.23 (0.86)	4.29 (0.92)	4.88 (1.04)	9.96 (1.57)	8.98 (2.03)
	6.40	2.35 (0.70)	2.96 (0.79)	3.98 (0.84)	4.50 (0.96)	9.34 (1.38)	8.27 (1.83)
	7.20	2.17 (0.65)	2.75 (0.75)	3.72 (0.79)	4.21 (0.91)	8.82 (1.24)	7.64 (1.69)
	8.00	2.04 (0.62)	2.57 (0.70)	3.51 (0.75)	3.94 (0.85)	8.39 (1.17)	7.13 (1.56)
Σ_{OC_4}	0.80	8.08 (2.58)	15.2 (6.38)	12.8 (4.13)	17.7 (7.75)	29.9 (13.6)	21.5 (10.4)
	1.60	5.12 (1.30)	8.46 (2.70)	8.03 (1.80)	9.26 (3.11)	17.6 (4.62)	10.4 (3.55)
	2.40	3.96 (0.91)	6.18 (1.81)	6.34 (1.23)	6.64 (2.00)	13.7 (2.65)	7.40 (2.19)
	3.20	3.31 (0.74)	4.97 (1.40)	5.34 (0.93)	5.34 (1.54)	11.6 (1.78)	5.89 (1.65)
	4.00	2.87 (0.64)	4.22 (1.17)	4.69 (0.78)	4.52 (1.25)	10.3 (1.38)	4.99 (1.36)
	4.80	2.55 (0.57)	3.73 (1.01)	4.21 (0.68)	3.95 (1.08)	9.33 (1.10)	4.33 (1.15)
	5.60	2.31 (0.53)	3.34 (0.92)	3.86 (0.62)	3.54 (0.97)	8.62 (0.95)	3.89 (1.02)
	6.40	2.11 (0.47)	3.03 (0.84)	3.56 (0.57)	3.22 (0.89)	8.05 (0.82)	3.56 (0.92)
	7.20	1.97 (0.40)	2.79 (0.78)	3.32 (0.53)	2.96 (0.83)	7.59 (0.74)	3.24 (0.87)
	8.00	1.86 (0.40)	2.58 (0.74)	3.12 (0.48)	2.75 (0.77)	7.20 (0.67)	3.01 (0.80)

Table 6. ARL_1 (STD) comparison between the HMT chart and the MaxNorm chart for Σ_{OC_j} , $j \in \{5, 6, 7\}$, when $n = 50$.

	$\Delta/\sqrt{n_t}$	$p = 5$		$p = 10$		$p = 30$	
		HMT	MaxNorm	HMT	MaxNorm	HMT	MaxNorm
Σ_{OC_5}	0.80	8.73 (3.62)	10.4 (4.66)	14.0 (5.51)	14.5 (6.62)	34.7 (18.6)	23.3 (12.6)
	1.60	5.59 (1.97)	6.32 (2.40)	8.92 (2.75)	8.69 (3.06)	20.8 (7.54)	12.6 (5.14)
	2.40	4.31 (1.46)	4.77 (1.71)	7.00 (1.97)	6.64 (2.15)	16.1 (4.54)	9.25 (3.43)
	3.20	3.62 (1.21)	3.95 (1.38)	5.94 (1.57)	5.54 (1.73)	13.7 (3.24)	7.40 (2.63)
	4.00	3.13 (1.06)	3.39 (1.18)	5.23 (1.35)	4.79 (1.48)	12.2 (2.59)	6.33 (2.16)
	4.80	2.81 (0.94)	3.02 (1.06)	4.71 (1.19)	4.31 (1.32)	11.1 (2.20)	5.56 (1.83)
	5.60	2.55 (0.88)	2.72 (0.97)	4.30 (1.11)	3.93 (1.20)	10.3 (1.94)	5.03 (1.64)
	6.40	2.36 (0.83)	2.50 (0.88)	4.01 (1.00)	3.61 (1.09)	9.65 (1.70)	4.59 (1.49)
	7.20	2.16 (0.77)	2.30 (0.84)	3.73 (0.96)	3.37 (1.03)	9.10 (1.55)	4.25 (1.39)
	8.00	2.03 (0.74)	2.16 (0.80)	3.52 (0.89)	3.13 (0.96)	8.63 (1.43)	3.95 (1.29)
Σ_{OC_6}	0.80	8.44 (3.02)	9.58 (3.52)	13.4 (4.80)	10.8 (4.03)	32.2 (15.7)	12.4 (4.75)
	1.60	5.43 (1.70)	5.74 (1.81)	8.60 (2.34)	6.28 (1.94)	19.5 (6.21)	7.07 (2.17)
	2.40	4.24 (1.29)	4.22 (1.35)	6.84 (1.73)	4.79 (1.43)	15.4 (3.78)	5.31 (1.53)
	3.20	3.56 (1.09)	3.66 (1.11)	5.83 (1.40)	3.99 (1.17)	13.2 (2.88)	4.44 (1.24)
	4.00	3.11 (0.97)	3.20 (0.99)	5.12 (1.21)	3.48 (1.03)	11.8 (2.36)	3.86 (1.10)
	4.80	2.79 (0.88)	2.86 (0.90)	4.65 (1.09)	3.10 (0.93)	10.8 (1.98)	3.46 (0.97)
	5.60	2.53 (0.82)	2.59 (0.83)	4.29 (1.01)	2.86 (0.87)	10.1 (1.75)	3.15 (0.92)
	6.40	2.33 (0.77)	2.41 (0.79)	3.96 (0.94)	2.64 (0.83)	9.51 (1.62)	2.92 (0.86)
	7.20	2.17 (0.73)	2.22 (0.74)	3.74 (0.89)	2.46 (0.77)	9.02 (1.44)	2.74 (0.82)
	8.00	2.02 (0.71)	2.08 (0.73)	3.52 (0.86)	2.31 (0.74)	8.58 (1.34)	2.58 (0.78)
Σ_{OC_7}	0.80	8.39 (3.29)	9.70 (4.27)	13.5 (5.24)	13.1 (5.85)	32.9 (17.3)	19.7 (9.94)
	1.60	5.35 (1.82)	5.76 (2.14)	8.52 (2.51)	7.87 (2.74)	19.7 (6.69)	11.0 (4.34)
	2.40	4.08 (1.29)	4.39 (1.53)	6.67 (1.78)	6.00 (1.93)	15.4 (4.05)	8.05 (2.90)
	3.20	3.43 (1.09)	3.58 (1.21)	5.64 (1.40)	4.99 (1.53)	12.9 (2.87)	6.53 (2.27)
	4.00	2.97 (0.94)	3.09 (1.04)	4.94 (1.20)	4.35 (1.32)	11.5 (2.26)	5.56 (1.86)
	4.80	2.64 (0.84)	2.73 (0.92)	4.46 (1.05)	3.86 (1.17)	10.5 (1.91)	4.91 (1.62)
	5.60	2.39 (0.76)	2.46 (0.84)	4.05 (0.95)	3.50 (1.04)	9.68 (1.64)	4.42 (1.43)
	6.40	2.19 (0.71)	2.24 (0.77)	3.76 (0.87)	3.20 (0.97)	9.06 (1.47)	4.03 (1.30)
	7.20	2.04 (0.67)	2.07 (0.73)	3.51 (0.83)	3.00 (0.91)	8.56 (1.36)	3.73 (1.18)
	8.00	1.90 (0.65)	1.92 (0.68)	3.30 (0.77)	2.80 (0.87)	8.12 (1.24)	3.47 (1.12)

Table 7. ARL₁ (STD) comparison between the MEWMC-based PLR chart, the LMEWMC chart and the MaxNorm chart for Σ_{OC_j} , $j \in \{1, 2\}$, when $n = 1$.

		$p = 5$							$p = 30$						
Δ		MEWMC-based PLR with ρ			LMEWMC with ρ			MaxNorm	MEWMC-based PLR with ρ			LMEWMC with ρ			MaxNorm
		0.05	0.20	1.00	0.05	0.20	1.00		0.05	0.20	1.00	0.05	0.20	1.00	
Σ_{OC_1}															
0.6		33.7	25.7	17.4	34.0	27.1	25.8	22.6	47.0	30.9	17.8	45.2	29.6	39.9	31.0
		(28.3)	(20.9)	(14.0)	(28.6)	(22.3)	(22.0)	(19.1)	(28.9)	(19.6)	(12.9)	(27.1)	(18.2)	(34.7)	(23.9)
0.8		27.9	21.3	14.5	28.3	22.4	21.9	18.6	40.7	25.9	14.6	38.4	25.3	33.5	25.1
		(22.7)	(17.1)	(11.5)	(23.1)	(17.9)	(18.6)	(15.7)	(24.1)	(15.1)	(9.73)	(21.1)	(14.1)	(28.2)	(18.7)
1.0		23.8	18.0	12.5	24.3	18.9	18.7	16.0	35.9	22.8	12.8	34.3	22.2	28.1	21.3
		(18.9)	(14.3)	(9.97)	(19.3)	(14.7)	(15.7)	(13.0)	(19.9)	(12.7)	(8.54)	(18.0)	(11.9)	(23.2)	(15.0)
1.2		20.4	15.9	11.2	21.2	16.8	16.4	14.3	32.5	20.4	11.4	31.4	19.9	25.3	18.7
		(15.7)	(12.2)	(8.59)	(16.4)	(13.0)	(13.4)	(11.4)	(17.0)	(10.9)	(7.06)	(15.6)	(10.1)	(20.2)	(12.9)
1.4		18.6	14.4	9.98	19.1	15.3	15.1	12.8	29.6	18.7	10.3	28.9	18.5	22.5	17.1
		(14.3)	(10.9)	(7.55)	(15.0)	(11.7)	(12.2)	(10.1)	(14.3)	(9.51)	(6.17)	(13.4)	(8.99)	(17.7)	(11.3)
1.6		16.8	13.1	9.33	17.2	14.0	13.6	11.7	27.6	17.3	9.47	26.9	17.1	20.5	15.5
		(12.7)	(9.72)	(7.02)	(13.1)	(10.4)	(10.9)	(9.10)	(13.3)	(8.23)	(5.61)	(12.2)	(7.77)	(15.7)	(9.87)
1.8		15.5	12.1	8.62	15.7	12.8	12.8	10.8	25.7	16.2	8.77	25.4	16.1	19.1	14.2
		(11.6)	(8.94)	(6.43)	(11.7)	(9.50)	(10.3)	(8.33)	(11.5)	(7.50)	(5.20)	(10.5)	(6.99)	(14.3)	(8.98)
2.0		14.6	11.3	8.05	14.6	11.8	12.0	10.2	24.4	15.2	8.13	24.1	15.2	17.9	13.3
		(10.8)	(8.47)	(6.00)	(10.7)	(8.78)	(9.43)	(7.89)	(10.4)	(6.73)	(4.69)	(9.73)	(6.48)	(13.4)	(8.13)
Σ_{OC_2}															
0.6		47.5	40.8	33.9	50.0	44.6	32.2	32.7	118	102	70	123	118	61.9	54.3
		(39.0)	(34.8)	(29.6)	(42.0)	(37.8)	(28.4)	(29.0)	(92.2)	(85.7)	(63.6)	(97.2)	(103)	(56.8)	(48.2)
0.8		40.3	34.0	28.2	42.2	37.0	26.2	27.3	107	92.1	60.1	112	107	50.4	44.5
		(33.2)	(28.2)	(24.7)	(34.5)	(30.7)	(22.8)	(23.7)	(82.2)	(75.9)	(54.1)	(86.0)	(90.0)	(44.0)	(39.2)
1.0		35.1	29.4	24.9	36.0	32.8	22.6	23.3	97.8	83.2	53.3	106	97.2	43.3	37.5
		(28.1)	(24.2)	(21.4)	(29.0)	(27.1)	(19.2)	(20.0)	(75.0)	(67.8)	(46.3)	(82.5)	(82.5)	(37.7)	(32.1)
1.2		31.7	26.6	22.1	32.2	29.2	20.3	20.8	91.3	77.3	47.0	98.1	92.1	37.5	33.2
		(24.6)	(21.5)	(19.1)	(25.6)	(24.0)	(17.2)	(17.5)	(67.8)	(60.9)	(40.9)	(73.8)	(76.3)	(32.6)	(27.8)
1.4		28.7	24.2	20.2	29.3	26.7	18.7	19.1	86.8	71.8	43.6	92.8	86.7	33.7	29.8
		(22.6)	(19.3)	(17.2)	(23.0)	(21.6)	(16.2)	(16.1)	(63.7)	(56.6)	(36.8)	(68.5)	(71.1)	(28.6)	(25.0)
1.6		26.4	22.7	18.2	27.0	24.5	17.0	17.4	80.9	67.2	39.2	87.0	82.5	30.6	26.9
		(20.6)	(18.0)	(15.4)	(20.5)	(19.4)	(14.3)	(14.5)	(58.8)	(52.7)	(32.6)	(64.2)	(67.5)	(25.9)	(22.2)
1.8		24.6	20.8	17.5	25.1	23.0	15.7	16.4	76.7	63.4	36.5	82.6	76.5	28.3	24.7
		(18.5)	(16.0)	(14.6)	(19.4)	(18.2)	(13.1)	(13.9)	(54.3)	(47.6)	(30.3)	(59.9)	(61.2)	(23.7)	(20.4)
2.0		23.4	19.5	16.1	23.7	21.4	14.7	15.4	73.1	60.1	35.0	78.9	72.5	26.0	22.8
		(17.9)	(14.9)	(13.2)	(17.8)	(16.8)	(12.3)	(12.8)	(50.6)	(45.8)	(28.7)	(55.3)	(57.2)	(21.3)	(18.7)

Table 8. ARL_1 (STD) comparison between the MEWMC-based PLR chart, the LMEWMC chart and the MaxNorm chart for Σ_{OC_j} , $j \in \{3, 4\}$, when $n = 1$.

		$p = 5$						$p = 30$							
Δ	MEWMC-based PLR with ρ			LMEWMC with ρ			MaxNorm	MEWMC-based PLR with ρ			LMEWMC with ρ			MaxNorm	
	0.05	0.20	1.00	0.05	0.20	1.00		0.05	0.20	1.00	0.05	0.20	1.00		
Σ_{OC_3}															
0.6	58.6	63.9	164	58.7	59.6	158	96.2	157	159	190	157	161	186	183	
	(47.2)	(55.5)	(163)	(47.2)	(50.9)	(154)	(90.8)	(131)	(143)	(183)	(131)	(144)	(179)	(176)	
0.8	47.8	52.5	153	48.2	48.3	143	79.8	145	151	189	147	149	170	176	
	(36.5)	(43.5)	(153)	(37.4)	(39.4)	(137)	(73.5)	(119)	(133)	(184)	(123)	(132)	(163)	(168)	
1.0	41.0	45.4	143	41.0	41.1	133	69.1	136	141	179	135	142	167	173	
	(30.5)	(36.6)	(143)	(30.5)	(32.7)	(129)	(63.6)	(108)	(125)	(175)	(109)	(123)	(159)	(167)	
1.2	36.2	39.7	137	35.9	36.2	124	59.9	125	133	181	126	134	157	163	
	(26.5)	(31.6)	(134)	(25.1)	(27.5)	(116)	(54.4)	(102)	(113)	(176)	(100)	(115)	(148)	(158)	
1.4	32.5	35.7	131	32.1	32.7	116	54.8	121	124	175	119	124	152	162	
	(22.5)	(27.3)	(129)	(22.4)	(24.6)	(108)	(49.1)	(94.4)	(107)	(166)	(93.4)	(105)	(143)	(155)	
1.6	29.6	32.3	123	29.2	29.8	107	49.3	113	116	172	115	121	142	151	
	(19.5)	(24.4)	(120)	(19.4)	(21.9)	(101)	(43.8)	(86.9)	(99.0)	(167)	(88.8)	(104)	(139)	(142)	
1.8	27.0	29.8	118	27.3	27.1	102	44.8	106	110	166	107	113	136	147	
	(17.6)	(21.8)	(117)	(17.6)	(19.6)	(95.6)	(38.5)	(79.3)	(91.0)	(161)	(81.3)	(93.7)	(130)	(141)	
2.0	24.9	27.5	115	25.1	25.6	92.8	41.2	102	104	165	102	108	128	143	
	(15.6)	(19.8)	(112)	(16.1)	(18.7)	(84.9)	(35.7)	(77.3)	(86.3)	(158)	(76.1)	(91.5)	(121)	(135)	
Σ_{OC_4}															
0.6	48.2	57.5	144	47.8	50.1	97.3	102	145	150	183	144	149	143	179	
	(34.5)	(46.7)	(139.1)	(33.9)	(39.4)	(90.5)	(97.4)	(119)	(131)	(177)	(117)	(132)	(134)	(171)	
0.8	36.7	45.3	129	36.4	38.5	75.3	86.9	127	132	174	128	131	116	169	
	(23.2)	(34.8)	(127)	(22.9)	(27.9)	(65.7)	(80.8)	(101)	(114)	(169)	(100)	(115)	(107)	(164)	
1.0	29.7	36.0	115	29.1	31.2	58.8	75.1	113	120	165	113	118	95.3	153	
	(16.3)	(25.2)	(110)	(16.0)	(20.3)	(50.2)	(68.5)	(86.6)	(101)	(156)	(84.9)	(98.9)	(84.2)	(144)	
1.2	24.5	30.1	101	24.3	26.1	47.7	64.8	99.3	107	156	98.8	100	77.7	138	
	(11.7)	(19.1)	(96.7)	(11.5)	(16.1)	(40.0)	(57.7)	(71.6)	(88.9)	(150)	(70.8)	(82.2)	(67.1)	(132)	
1.4	20.9	25.6	90.0	20.7	22.5	40.2	57.6	86.0	94.9	149	84.1	86.2	65.3	124	
	(8.54)	(14.7)	(35.3)	(8.49)	(12.7)	(31.4)	(50.6)	(60.2)	(74.0)	(142)	(55.7)	(66.6)	(54.2)	(115)	
1.6	18.3	22.1	82.7	18.1	19.8	34.8	49.9	74.2	85.4	140	70.8	71.4	57.0	109	
	(6.53)	(11.4)	(77.5)	(6.53)	(10.4)	(26.6)	(42.9)	(47.1)	(65.3)	(132)	(42.4)	(50.8)	(45.8)	(101)	
1.8	16.3	19.7	75.5	16.3	17.9	30.7	44.8	62.7	74.5	128	58.1	57.2	48.7	98.4	
	(5.01)	(9.14)	(69.0)	(5.13)	(8.90)	(22.7)	(37.7)	(34.6)	(54.9)	(120)	(29.4)	(36.4)	(38.4)	(90.2)	
2.0	14.7	17.4	66.8	14.8	16.1	27.5	40.5	51.2	67.1	122	43.0	43.0	42.8	86.1	
	(4.14)	(7.30)	(60.8)	(4.25)	(7.62)	(19.6)	(33.2)	(23.3)	(46.7)	(113)	(13.8)	(20.1)	(32.8)	(77.1)	

Table 9. ARL₁ (STD) comparison between the MEWMC-based PLR chart, the LMEWMC chart and the MaxNorm chart for Σ_{OC_j} , $j \in \{5, 6\}$, when $n = 1$.

		$p = 5$							$p = 30$						
Δ		MEWMC-based PLR with ρ			LMEWMC with ρ			MaxNorm	MEWMC-based PLR with ρ			LMEWMC with ρ			MaxNorm
		0.05	0.20	1.00	0.05	0.20	1.00		0.05	0.20	1.00	0.05	0.20	1.00	
Σ_{OC_5}															
0.6		49.7	42.7	41.3	48.8	42.7	49.8	42.4	119	106	85.2	120	109	97.1	97.9
		(41.8)	(36.2)	(37.3)	(40.8)	(36.3)	(45.5)	(38.7)	(94.3)	(89.2)	(79.2)	(96.7)	(91.5)	(91.1)	(90.5)
0.8		41.1	35.8	35.0	41.2	35.3	42.6	36.5	108	93.8	74.2	109	97.3	81.7	85.9
		(34.1)	(30.1)	(31.6)	(33.9)	(28.9)	(39.1)	(32.4)	(84.1)	(76.9)	(67.2)	(84.8)	(80.6)	(74.1)	(79.1)
1.0		35.3	30.8	30.6	35.8	31.2	37.8	31.1	99.7	86.1	65.7	101	90.8	71.6	75.2
		(28.3)	(25.0)	(26.6)	(28.8)	(25.7)	(33.0)	(27.1)	(76.7)	(70.1)	(58.5)	(77.3)	(73.6)	(64.9)	(68.5)
1.2		31.9	28.0	27.4	32.2	28.1	33.5	27.7	93.8	79.5	60.1	94.7	86.2	62.2	67.7
		(25.1)	(22.6)	(23.9)	(25.4)	(22.8)	(29.6)	(23.7)	(70.0)	(63.6)	(54.1)	(70.4)	(70.6)	(55.8)	(60.8)
1.4		29.3	25.1	25.0	29.4	25.7	30.1	25.4	87.1	74.1	55.9	88.7	80.8	55.3	62.0
		(22.7)	(20.1)	(21.7)	(23.2)	(20.4)	(26.2)	(21.3)	(63.8)	(59.6)	(49.9)	(64.6)	(65.3)	(48.1)	(55.6)
1.6		26.6	23.2	23.1	26.9	23.7	27.7	22.9	81.6	69.9	51.2	84.1	76.0	50.7	57.6
		(20.5)	(18.6)	(19.8)	(20.7)	(18.6)	(24.3)	(19.7)	(58.4)	(53.9)	(45.0)	(61.2)	(60.1)	(44.1)	(50.7)
1.8		24.8	21.4	21.4	24.9	21.7	26.0	21.5	78.7	64.7	47.3	80.1	72.4	47.8	52.6
		(19.2)	(17.0)	(18.5)	(18.6)	(17.0)	(22.5)	(17.8)	(56.3)	(49.9)	(41.9)	(57.1)	(56.4)	(42.0)	(45.6)
2.0		23.0	20.3	20.1	23.5	20.2	24.1	20.3	73.9	61.6	44.4	76.3	68.9	42.8	49.2
		(17.2)	(16.0)	(17.3)	(17.6)	(15.4)	(20.8)	(17.2)	(50.9)	(46.1)	(38.3)	(52.6)	(53.5)	(37.1)	(42.8)
Σ_{OC_6}															
0.6		51.1	49.0	59.4	52.5	47.4	62.3	56.0	131	121	109	131	125	106	120
		(42.2)	(42.0)	(55.3)	(43.6)	(39.7)	(56.6)	(51.3)	(106)	(104)	(102)	(106)	(110)	(100)	(115)
0.8		43.0	40.1	47.1	42.8	39.2	48.6	44.6	118	108	92.4	119	112	82.8	102
		(34.0)	(33.0)	(43.2)	(33.7)	(32.0)	(43.9)	(40.6)	(93.7)	(92.5)	(84.4)	(92.9)	(94.7)	(75.4)	(95.1)
1.0		37.5	34.0	39.6	37.5	34.4	40.7	36.7	109	96.7	77.3	111	102	68.5	85.8
		(29.2)	(28.0)	(36.1)	(29.4)	(28.0)	(35.6)	(31.8)	(84.6)	(80.6)	(70.3)	(85.0)	(86.1)	(62.5)	(78.7)
1.2		32.7	30.2	33.5	33.2	29.7	34.7	32.2	98.0	88.4	69.6	102	95.4	58.8	73.5
		(25.2)	(24.7)	(30.1)	(26.0)	(23.5)	(30.5)	(27.5)	(74.0)	(72.6)	(63.2)	(78.1)	(78.3)	(51.8)	(66.6)
1.4		29.6	26.8	29.0	30.3	26.9	30.5	28.4	92.3	80.0	60.8	96.0	88.6	51.7	63.7
		(22.8)	(21.8)	(25.4)	(22.8)	(20.9)	(25.7)	(24.4)	(69.1)	(63.1)	(54.1)	(71.1)	(72.9)	(45.1)	(58.0)
1.6		27.4	24.4	26.3	27.5	24.8	27.3	25.3	86.4	74.5	55.2	90.0	81.7	46.0	56.6
		(20.4)	(19.2)	(23.1)	(21.2)	(19.4)	(23.2)	(21.4)	(62.9)	(59.1)	(48.8)	(65.9)	(64.4)	(39.6)	(49.4)
1.8		25.3	22.7	23.9	25.4	22.8	24.9	22.8	82.8	70.3	49.7	85.5	78.4	41.4	50.7
		(18.8)	(17.7)	(20.7)	(19.0)	(17.7)	(20.8)	(19.3)	(59.6)	(54.6)	(43.0)	(62.2)	(62.7)	(34.5)	(44.1)
2.0		23.7	21.0	21.7	23.9	21.5	22.6	21.1	77.7	64.7	45.4	80.6	74.0	37.5	45.6
		(17.7)	(16.3)	(18.7)	(17.6)	(16.5)	(19.0)	(17.9)	(55.1)	(49.8)	(39.1)	(58.0)	(58.2)	(31.8)	(39.8)

Table 10. ARL₁ (STD) comparison between the MEWMC-based PLR chart, the LMEWMC chart and the MaxNorm chart for Σ_{OC_j} , $j = 7$, when $n = 1$.

		$p = 5$							$p = 30$						
Δ	MEWMC-based PLR with ρ			LMEWMC with ρ			MaxNorm	MEWMC-based PLR with ρ			LMEWMC with ρ			MaxNorm	
	0.05	0.20	1.00	0.05	0.20	1.00		0.05	0.20	1.00	0.05	0.20	1.00		
Σ_{OC_7}															
0.6	42.9	35.1	29.2	43.2	36.2	39.2	33.8	105	88.6	65.9	106	93.1	84.1	79.6	
	(35.7)	(29.8)	(25.4)	(36.0)	(30.2)	(35.3)	(29.3)	(81.1)	(72.0)	(59.9)	(81.8)	(76.1)	(73.5)	(73.3)	
0.8	34.9	28.9	24.5	35.2	29.8	33.5	28.3	96.5	78.3	57.3	96.2	83.5	68.0	68.2	
	(27.3)	(23.7)	(21.1)	(28.1)	(24.2)	(29.9)	(23.7)	(74.4)	(63.6)	(50.2)	(72.2)	(69.2)	(62.1)	(62.0)	
1.0	30.7	25.1	21.1	30.9	26.1	28.6	23.9	87.0	70.5	49.6	88.1	76.0	59.4	59.9	
	(25.1)	(20.3)	(17.7)	(24.6)	(21.0)	(24.4)	(20.5)	(64.6)	(55.0)	(43.4)	(65.5)	(60.0)	(51.9)	(52.7)	
1.2	26.8	22.6	19.3	26.9	23.1	25.6	21.7	80.1	64.3	45.2	82.1	70.6	52.0	52.7	
	(20.9)	(17.8)	(16.2)	(20.8)	(18.0)	(21.9)	(18.1)	(57.5)	(48.5)	(39.5)	(59.6)	(54.7)	(46.3)	(46.1)	
1.4	24.2	20.7	17.5	24.5	20.8	23.3	19.4	74.7	59.7	40.4	76.4	65.1	45.9	47.4	
	(18.4)	(16.2)	(14.6)	(18.7)	(16.0)	(20.1)	(16.0)	(53.1)	(44.8)	(34.1)	(53.5)	(49.6)	(40.4)	(41.6)	
1.6	22.5	18.5	15.8	22.3	18.9	21.4	18.2	70.0	55.3	36.8	73.2	61.3	41.9	43.4	
	(16.8)	(14.0)	(12.7)	(16.9)	(14.3)	(18.0)	(14.9)	(47.1)	(41.0)	(30.8)	(50.5)	(46.1)	(35.6)	(36.8)	
1.8	20.7	17.6	14.7	20.6	17.5	19.6	16.4	66.1	52.4	35.0	68.2	58.0	38.0	39.9	
	(15.3)	(13.4)	(11.9)	(15.0)	(13.4)	(16.0)	(13.3)	(43.9)	(37.6)	(28.8)	(45.9)	(43.0)	(32.1)	(34.1)	
2.0	19.3	16.3	13.8	19.3	16.8	18.7	15.5	62.4	49.4	31.7	65.3	54.8	35.0	37.2	
	(14.1)	(12.3)	(11.1)	(14.0)	(12.8)	(15.3)	(12.4)	(40.4)	(35.0)	(25.4)	(43.5)	(40.5)	(28.6)	(31.4)	

Table 11. ARL_1 (STD) comparison between the MEWMC-based PLR chart and the MaxNorm chart for Σ_{OC_j} , $j \in \{1, 2, 3, 4\}$, when $n = 50$.

$p = 5$					$p = 30$				
Δ	MEWMC-based PLR with ρ			MaxNorm	MEWMC-based PLR with ρ			MaxNorm	
	0.05	0.20	1.00		0.05	0.20	1.00		
Σ_{OC_1}	0.6	10.7 (4.99)	4.63 (2.51)	3.44 (1.77)	9.75 (4.62)	31.8 (17.9)	6.48 (2.97)	1.54 (1.04)	23.9 (13.2)
	0.8	8.35 (3.47)	3.78 (1.92)	2.93 (1.43)	7.76 (3.43)	23.8 (11.1)	5.32 (2.26)	1.36 (0.76)	18.6 (8.63)
	1.0	7.04 (2.79)	3.22 (1.61)	2.61 (1.19)	6.56 (2.71)	19.4 (7.80)	4.54 (1.82)	1.25 (0.59)	15.6 (6.38)
	1.2	6.12 (2.31)	2.78 (1.38)	2.38 (1.04)	5.73 (2.22)	16.6 (5.85)	4.03 (1.56)	1.18 (0.46)	13.5 (4.98)
	1.4	5.43 (1.98)	2.52 (1.23)	2.19 (0.93)	5.14 (1.95)	14.7 (4.69)	3.61 (1.33)	1.14 (0.41)	12.1 (4.18)
	1.6	4.95 (1.74)	2.28 (1.10)	2.06 (0.84)	4.67 (1.72)	13.3 (3.88)	3.31 (1.21)	1.10 (0.36)	11.1 (3.56)
	1.8	4.52 (1.58)	2.08 (1.00)	1.96 (0.78)	4.29 (1.54)	12.2 (3.28)	3.04 (1.09)	1.08 (0.30)	10.3 (3.11)
	2.0	4.20 (1.42)	1.93 (0.94)	1.86 (0.75)	3.99 (1.41)	11.4 (2.89)	2.85 (0.99)	1.06 (0.25)	9.62 (2.79)
Σ_{OC_2}	0.6	10.3 (4.76)	6.25 (3.34)	7.18 (5.79)	7.58 (3.79)	30.3 (15.0)	11.9 (5.84)	15.3 (25.2)	9.16 (4.59)
	0.8	8.37 (3.60)	5.14 (2.57)	5.79 (4.53)	6.04 (2.91)	24.2 (10.2)	9.68 (4.31)	11.1 (18.1)	7.34 (3.48)
	1.0	7.16 (2.94)	4.40 (2.16)	4.82 (3.66)	5.10 (2.41)	20.6 (7.79)	8.34 (3.45)	8.71 (14.2)	6.15 (2.81)
	1.2	6.27 (2.47)	3.87 (1.86)	4.22 (3.09)	4.50 (2.06)	18.2 (6.25)	7.38 (2.96)	7.18 (11.5)	5.31 (2.40)
	1.4	5.64 (2.16)	3.48 (1.69)	3.79 (2.71)	4.01 (1.82)	16.4 (5.12)	6.66 (2.56)	6.23 (9.58)	4.77 (2.07)
	1.6	5.17 (1.97)	3.17 (1.50)	3.34 (2.42)	3.64 (1.66)	15.2 (4.48)	6.14 (2.27)	5.36 (8.19)	4.30 (1.85)
	1.8	4.76 (1.78)	2.93 (1.39)	3.02 (2.18)	3.35 (1.53)	14.0 (3.80)	5.67 (2.08)	4.65 (7.07)	3.93 (1.66)
	2.0	4.44 (1.65)	2.76 (1.30)	3.02 (1.98)	3.13 (1.41)	13.2 (3.49)	5.31 (1.94)	4.24 (6.48)	3.65 (1.58)
Σ_{OC_3}	0.6	13.3 (5.40)	195 (191)	192 (202)	14.9 (6.56)	37.1 (20.0)	198 (193)	200 (290)	67.4 (49.6)
	0.8	10.9 (4.07)	195 (192)	192 (207)	11.9 (4.52)	28.7 (12.7)	202 (200)	199 (295)	47.9 (30.5)
	1.0	9.36 (3.23)	191 (190)	189 (198)	10.1 (3.51)	23.7 (9.04)	201 (199)	198 (296)	36.7 (19.8)
	1.2	8.28 (2.69)	191 (185)	188 (200)	8.86 (2.91)	20.3 (6.82)	201 (202)	198 (292)	30.2 (14.4)
	1.4	7.48 (2.35)	184 (183)	184 (193)	7.92 (2.49)	18.3 (5.56)	201 (200)	197 (295)	26.0 (11.2)
	1.6	6.86 (2.06)	176 (168)	186 (197)	7.22 (2.17)	16.6 (4.62)	197 (195)	197 (292)	22.7 (8.60)
	1.8	6.34 (1.88)	163 (158)	177 (187)	6.69 (1.97)	15.3 (3.92)	191 (188)	197 (289)	20.6 (7.29)
	2.0	5.98 (1.70)	144 (136)	181 (194)	6.24 (1.81)	14.2 (3.44)	184 (177)	198 (287)	18.7 (6.04)
Σ_{OC_4}	0.6	9.76 (3.42)	41.3 (26.7)	193 (206)	11.8 (4.49)	27.3 (11.5)	67.4 (51.3)	202 (297)	15.8 (6.38)
	0.8	7.94 (2.49)	25.2 (12.1)	193 (204)	9.25 (3.17)	21.7 (7.46)	37.1 (21.4)	198 (289)	11.8 (4.19)
	1.0	6.76 (2.00)	18.5 (7.41)	188 (199)	7.74 (2.44)	18.3 (5.34)	25.6 (11.6)	200 (290)	9.65 (3.14)
	1.2	5.96 (1.64)	14.8 (5.01)	189 (200)	6.69 (1.97)	16.1 (4.18)	19.7 (7.59)	201 (292)	8.24 (2.49)
	1.4	5.37 (1.42)	12.7 (3.96)	182 (193)	5.99 (1.72)	14.6 (3.33)	16.4 (5.55)	196 (293)	7.28 (2.09)
	1.6	4.93 (1.27)	11.1 (3.15)	186 (198)	5.38 (1.50)	13.3 (2.79)	14.3 (4.35)	197 (288)	6.51 (1.80)
	1.8	4.53 (1.14)	9.97 (2.66)	178 (189)	4.95 (1.35)	12.4 (2.43)	12.7 (3.60)	199 (291)	5.97 (1.61)
	2.0	4.23 (1.04)	9.08 (2.30)	179 (189)	4.59 (1.23)	11.6 (2.11)	11.5 (2.98)	197 (294)	5.51 (1.41)

Table 12. ARL_1 (STD) comparison between the MEWMC-based PLR chart and the MaxNorm chart for Σ_{OC_j} , $j \in \{5, 6, 7\}$, when $n = 50$.

$p = 5$					$p = 30$				
Δ	MEWMC-based PLR with ρ			MaxNorm	MEWMC-based PLR with ρ			MaxNorm	
	0.05	0.20	1.00		0.05	0.20	1.00		
Σ_{OC_5}									
0.6	12.3 (5.72)	11.8 (7.92)	8.27 (7.09)	13.3 (6.62)	33.8 (18.0)	24.9 (17.4)	19.0 (32.0)	31.4 (19.1)	
0.8	9.85 (4.17)	9.49 (5.84)	6.68 (5.47)	10.5 (4.69)	26.5 (11.9)	19.6 (12.1)	14.4 (24.7)	23.2 (12.3)	
1.0	8.38 (3.46)	7.98 (4.86)	5.57 (4.53)	8.77 (3.72)	22.3 (9.01)	16.5 (9.58)	11.2 (19.0)	19.1 (9.17)	
1.2	7.32 (2.80)	7.02 (4.01)	4.81 (3.81)	7.73 (3.10)	19.4 (6.75)	14.2 (7.71)	9.41 (15.7)	15.9 (7.18)	
1.4	6.56 (2.47)	6.24 (3.46)	4.26 (3.27)	6.85 (2.66)	17.5 (5.73)	12.5 (6.31)	7.78 (13.0)	14.1 (5.88)	
1.6	5.99 (2.20)	5.69 (3.06)	3.90 (2.95)	6.33 (2.36)	15.9 (4.84)	11.3 (5.53)	6.99 (11.8)	12.6 (5.13)	
1.8	5.59 (2.03)	5.17 (2.78)	3.53 (2.65)	5.79 (2.13)	14.7 (4.16)	10.4 (4.84)	6.18 (10.2)	11.5 (4.50)	
2.0	5.11 (1.83)	4.88 (2.59)	3.23 (2.39)	5.41 (1.98)	13.8 (3.72)	9.64 (4.35)	5.48 (8.90)	10.5 (4.08)	
Σ_{OC_6}									
0.6	10.3 (3.99)	33.1 (22.2)	49.8 (52.7)	12.2 (4.95)	29.1 (13.3)	54.9 (40.6)	93.4 (147)	16.4 (7.20)	
0.8	8.40 (2.99)	21.4 (11.7)	36.0 (37.0)	9.57 (3.54)	23.3 (9.06)	32.9 (20.2)	74.4 (117)	12.3 (4.68)	
1.0	7.17 (2.44)	16.1 (7.81)	26.8 (26.8)	8.08 (2.82)	19.8 (6.60)	23.5 (11.9)	59.4 (95.3)	10.2 (3.52)	
1.2	6.37 (2.13)	13.2 (6.01)	20.8 (20.5)	7.03 (2.34)	17.5 (5.34)	18.7 (8.32)	47.2 (76.8)	8.80 (2.87)	
1.4	5.76 (1.89)	11.2 (4.80)	16.8 (15.9)	6.31 (2.05)	15.9 (4.41)	15.7 (6.27)	39.7 (64.8)	7.79 (2.48)	
1.6	5.29 (1.72)	9.86 (4.01)	13.6 (12.8)	5.78 (1.78)	14.6 (3.77)	13.7 (5.09)	32.9 (53.6)	7.02 (2.15)	
1.8	4.89 (1.55)	8.83 (3.54)	11.7 (10.8)	5.30 (1.62)	13.6 (3.29)	12.2 (4.28)	27.6 (46.0)	6.50 (1.94)	
2.0	4.58 (1.44)	7.96 (3.18)	10.2 (9.14)	4.98 (1.54)	12.8 (3.02)	11.0 (3.76)	22.8 (37.4)	6.02 (1.78)	
Σ_{OC_7}									
0.6	11.7 (5.39)	8.26 (5.02)	4.95 (4.01)	12.1 (5.83)	32.3 (16.6)	17.0 (9.95)	10.0 (16.9)	26.2 (15.1)	
0.8	9.38 (3.98)	6.57 (3.79)	4.00 (3.06)	9.67 (4.22)	25.2 (11.1)	13.7 (7.38)	7.34 (12.3)	19.7 (9.91)	
1.0	7.92 (3.12)	5.59 (3.10)	3.30 (2.48)	8.13 (3.36)	21.2 (8.06)	11.5 (5.71)	5.67 (9.46)	16.1 (7.55)	
1.2	6.91 (2.63)	4.89 (2.58)	2.85 (2.08)	7.08 (2.78)	18.5 (6.25)	10.1 (4.75)	4.67 (7.68)	14.0 (6.05)	
1.4	6.21 (2.25)	4.40 (2.30)	2.57 (1.92)	6.36 (2.43)	16.6 (5.17)	8.98 (3.94)	3.88 (6.33)	12.2 (5.01)	
1.6	5.65 (2.02)	3.97 (2.02)	2.28 (1.70)	5.76 (2.14)	15.2 (4.36)	8.13 (3.51)	3.41 (5.55)	10.9 (4.33)	
1.8	5.14 (1.78)	3.67 (1.83)	2.06 (1.50)	5.34 (1.92)	14.1 (3.78)	7.55 (3.07)	2.94 (4.83)	9.95 (3.79)	
2.0	4.82 (1.65)	3.39 (1.70)	1.91 (1.40)	4.98 (1.75)	13.1 (3.30)	7.03 (2.81)	2.70 (4.43)	9.15 (3.45)	

Table 13. ARL_1 (STD) comparison between the PLR chart and the modified MaxNorm chart for Σ_{OC_j} , $j \in \{1, 2, 3, 4\}$, when $n = 20$.

		$p = 5$				$p = 10$			
Δ	PLR with ρ			M-MaxNorm	PLR with ρ			M-MaxNorm	
	0.05	0.20	1.00		0.05	0.20	1.00		
Σ_{OC_1}									
0.6	66.8 (68.2)	28.0 (28.5)	13.6 (14.5)	20.5 (21.0)	71.3 (72.5)	28.5 (29.0)	13.9 (14.3)	26.8 (27.0)	
0.8	52.3 (52.5)	20.6 (21.0)	9.66 (10.5)	15.8 (16.0)	59.0 (60.9)	22.3 (22.9)	10.0 (10.4)	20.4 (21.0)	
1.0	43.3 (43.8)	16.8 (17.2)	7.53 (7.97)	12.5 (13.0)	50.8 (52.2)	17.1 (17.4)	7.51 (8.04)	15.6 (16.2)	
1.2	36.1 (36.6)	13.8 (14.1)	5.96 (6.51)	9.95 (10.4)	43.0 (43.5)	14.4 (14.9)	6.08 (6.65)	12.9 (13.4)	
1.4	30.9 (30.9)	11.2 (11.9)	4.99 (5.43)	8.42 (9.06)	38.3 (39.3)	12.2 (12.6)	5.01 (5.56)	10.8 (11.5)	
1.6	26.4 (26.7)	9.71 (10.1)	4.17 (4.68)	7.11 (7.53)	33.1 (33.5)	10.2 (10.5)	4.10 (4.56)	9.19 (9.68)	
1.8	22.6 (22.9)	8.40 (8.82)	3.58 (4.05)	6.15 (6.67)	30.5 (30.7)	8.88 (9.38)	3.58 (4.10)	7.99 (8.47)	
2.0	20.3 (20.7)	7.27 (7.74)	3.13 (3.65)	5.30 (5.79)	26.7 (26.9)	7.71 (8.09)	3.13 (3.62)	6.92 (7.48)	
Σ_{OC_2}									
0.6	78.0 (79.1)	44.9 (44.8)	34.4 (35.2)	29.0 (29.7)	111 (111)	71.4 (70.6)	52.4 (52.7)	40.5 (40.8)	
0.8	64.2 (64.9)	35.6 (36.2)	26.3 (27.0)	21.7 (22.0)	97.4 (97.6)	59.8 (60.6)	42.4 (43.2)	30.1 (30.8)	
1.0	53.8 (54.2)	29.1 (30.8)	21.5 (21.8)	16.9 (17.5)	85.8 (85.3)	51.3 (51.6)	34.9 (36.0)	23.7 (23.9)	
1.2	44.0 (45.5)	23.9 (24.5)	17.7 (18.0)	14.1 (14.4)	76.7 (76.4)	43.4 (44.3)	29.9 (30.5)	19.1 (19.5)	
1.4	38.4 (39.2)	19.9 (20.5)	14.8 (15.2)	11.6 (12.3)	69.4 (70.0)	37.9 (38.3)	25.6 (26.0)	15.8 (16.4)	
1.6	34.0 (34.9)	17.3 (17.7)	12.9 (13.3)	9.92 (10.4)	61.0 (60.6)	33.7 (34.1)	22.6 (22.9)	13.2 (13.7)	
1.8	29.3 (29.5)	15.3 (16.0)	11.4 (12.0)	8.65 (9.23)	56.7 (56.6)	30.3 (30.6)	20.0 (20.8)	11.3 (11.8)	
2.0	25.8 (26.5)	13.3 (13.9)	10.2 (10.6)	7.53 (7.94)	51.7 (51.4)	26.3 (26.9)	17.3 (17.8)	10.2 (10.6)	
Σ_{OC_3}									
0.6	94.7 (94.4)	88.6 (88.5)	180 (179)	126 (125)	141 (141)	135 (137)	191 (190)	171 (171)	
0.8	75.2 (75.9)	71.2 (69.9)	174 (175)	107 (108)	126 (129)	116 (118)	186 (185)	159 (161)	
1.0	62.9 (64.3)	59.1 (59.5)	168 (168)	92.7 (93.7)	114 (113)	102 (103)	184 (182)	148 (149)	
1.2	53.9 (55.2)	48.6 (48.8)	166 (166)	81.6 (81.3)	102 (103)	90.9 (90.8)	180 (179)	137 (139)	
1.4	44.6 (45.0)	41.2 (41.5)	161 (162)	72.1 (72.2)	91.4 (92.4)	82.3 (82.7)	177 (173)	129 (128)	
1.6	38.4 (39.1)	34.8 (35.5)	155 (152)	63.7 (64.1)	84.8 (85.3)	73.8 (74.5)	174 (174)	123 (125)	
1.8	33.7 (34.5)	30.5 (30.5)	155 (150)	56.9 (57.8)	76.0 (77.1)	65.8 (67.3)	170 (170)	113 (115)	
2.0	29.4 (30.3)	26.4 (26.9)	147 (147)	50.5 (51.3)	69.7 (69.8)	60.6 (60.9)	167 (167)	107 (107)	
Σ_{OC_4}									
0.6	94.1 (94.6)	92.5 (93.2)	178 (178)	137 (138)	139 (140)	136 (137)	189 (187)	175 (176)	
0.8	76.1 (75.8)	76.1 (75.5)	173 (174)	120 (122)	123 (125)	120 (118)	184 (183)	168 (168)	
1.0	61.2 (62.0)	61.7 (62.8)	167 (169)	107 (108)	109 (108)	106 (106)	177 (177)	159 (161)	
1.2	50.5 (51.1)	50.5 (51.6)	156 (155)	98.0 (98.5)	96.5 (95.4)	93.3 (93.9)	176 (175)	150 (151)	
1.4	42.0 (42.1)	43.5 (43.3)	148 (149)	85.0 (86.8)	88.5 (89.3)	82.3 (82.0)	169 (170)	140 (137)	
1.6	35.3 (35.6)	36.0 (36.1)	140 (140)	76.8 (77.3)	79.2 (79.8)	73.0 (73.7)	164 (166)	134 (135)	
1.8	29.7 (29.9)	30.9 (31.0)	134 (132)	69.3 (69.8)	69.9 (71.2)	65.2 (66.5)	160 (163)	124 (128)	
2.0	24.8 (25.0)	26.8 (27.3)	123 (125)	62.4 (63.0)	62.8 (63.2)	58.0 (59.2)	152 (152)	117 (117)	

Table 14. ARL_1 (STD) comparison between the PLR chart and the modified MaxNorm chart for Σ_{OC_j} , $j \in \{5, 6, 7\}$, when $n = 20$.

$p = 5$					$p = 10$					
Δ	PLR with ρ				M-MaxNorm	PLR with ρ				M-MaxNorm
	0.05	0.20	1.00			0.05	0.20	1.00		
Σ_{OC_5}										
0.6	81.4 (82.2)	49.6 (49.8)	44.3 (45.0)	46.2 (46.6)	110 (111)	75.6 (75.9)	65.8 (66.7)	76.3 (78.1)		
0.8	65.5 (66.5)	37.9 (38.6)	36.3 (36.7)	36.4 (37.2)	98.8 (98.1)	63.0 (63.2)	55.5 (56.0)	61.5 (61.7)		
1.0	54.0 (54.1)	31.6 (31.9)	30.1 (30.5)	30.3 (30.3)	87.8 (88.0)	54.5 (54.8)	47.5 (48.6)	53.5 (53.6)		
1.2	46.1 (46.2)	26.4 (26.7)	25.5 (25.8)	25.0 (25.3)	78.1 (78.9)	46.2 (47.5)	41.5 (42.0)	45.8 (45.7)		
1.4	39.2 (40.0)	22.8 (23.5)	22.3 (22.4)	21.4 (21.6)	69.9 (71.1)	41.0 (41.8)	36.6 (37.4)	40.2 (40.4)		
1.6	34.9 (35.2)	19.1 (19.9)	19.7 (20.2)	18.4 (18.9)	64.5 (65.8)	36.3 (37.0)	33.3 (33.5)	35.6 (35.7)		
1.8	29.9 (30.6)	16.5 (17.1)	17.8 (18.1)	16.0 (16.7)	58.1 (57.5)	32.3 (33.2)	29.9 (30.2)	31.2 (31.8)		
2.0	26.4 (27.0)	14.8 (15.2)	15.6 (15.9)	14.2 (14.7)	52.9 (53.1)	28.8 (29.5)	26.6 (27.2)	28.1 (28.4)		
Σ_{OC_6}										
0.6	89.7 (90.5)	72.6 (72.5)	104 (104)	89.2 (90.2)	132 (133)	111 (112)	129 (129)	131 (132)		
0.8	73.0 (73.3)	56.8 (56.2)	85.5 (86.0)	70.8 (71.3)	114 (114)	92.3 (92.2)	112 (112)	112 (112)		
1.0	60.0 (60.7)	45.3 (45.3)	71.7 (72.7)	55.8 (56.6)	101 (103)	77.4 (77.1)	96.0 (96.0)	95.9 (95.8)		
1.2	50.1 (50.3)	36.1 (36.4)	60.2 (61.1)	45.6 (46.9)	91.1 (92.6)	66.6 (67.3)	85.2 (85.4)	82.4 (82.6)		
1.4	43.0 (43.7)	29.8 (30.2)	51.1 (50.5)	38.0 (38.9)	79.6 (81.4)	56.9 (58.3)	73.9 (72.7)	72.1 (73.9)		
1.6	36.4 (36.7)	25.9 (26.9)	44.0 (44.7)	31.6 (31.6)	71.6 (71.7)	49.7 (50.1)	64.1 (64.7)	61.0 (61.3)		
1.8	31.8 (31.7)	22.0 (22.5)	38.1 (38.2)	26.8 (26.7)	66.4 (67.4)	44.1 (45.0)	57.8 (59.1)	52.9 (53.3)		
2.0	27.1 (27.4)	19.0 (19.3)	33.1 (33.5)	23.3 (23.4)	58.9 (58.9)	38.7 (39.7)	51.2 (51.9)	46.3 (47.1)		
Σ_{OC_7}										
0.6	75.4 (76.4)	41.0 (41.6)	28.9 (29.2)	35.0 (35.6)	101 (103)	61.5 (60.5)	45.9 (46.4)	58.9 (60.2)		
0.8	61.2 (61.3)	31.4 (31.6)	22.6 (22.7)	27.4 (28.2)	89.2 (88.4)	50.3 (50.2)	36.6 (37.4)	48.3 (48.8)		
1.0	50.5 (50.8)	25.7 (26.2)	17.9 (18.4)	22.3 (23.0)	77.3 (78.5)	41.7 (42.2)	31.0 (31.6)	39.4 (40.2)		
1.2	42.5 (43.7)	21.3 (21.6)	14.8 (15.3)	18.3 (18.7)	69.2 (68.7)	36.0 (36.5)	26.1 (27.2)	33.7 (34.4)		
1.4	36.0 (36.9)	18.0 (18.4)	12.8 (13.4)	15.8 (16.2)	61.8 (61.6)	31.3 (31.3)	22.5 (23.1)	29.1 (29.3)		
1.6	31.5 (31.6)	15.1 (15.4)	11.3 (11.8)	13.5 (13.9)	55.8 (55.5)	27.5 (27.5)	19.6 (20.3)	25.5 (25.6)		
1.8	27.6 (28.0)	13.4 (13.7)	9.95 (10.5)	11.9 (12.5)	49.4 (48.7)	24.6 (24.8)	17.9 (18.5)	22.5 (22.7)		
2.0	24.3 (24.6)	11.7 (12.2)	8.69 (9.03)	10.5 (10.9)	45.1 (46.2)	21.4 (21.8)	15.5 (16.2)	19.6 (20.0)		

Table 15. ARL_1 (STD) comparison between the PLR chart and the modified MaxNorm chart for Σ_{OC_j} , $j \in \{1, 2, 3, 4\}$, when $n = 50$.

$p = 5$					$p = 30$				
Δ	PLR with ρ			M-MaxNorm	PLR with ρ			M-MaxNorm	
	0.05	0.20	1.00		0.05	0.20	1.00		
Σ_{OC_1}	0.6	47.5 (47.4)	17.1 (17.4)	7.38 (7.82)	14.9 (15.4)	57.1 (57.8)	18.9 (19.5)	7.54 (8.14)	33.2 (33.8)
	0.8	35.0 (34.8)	12.0 (12.4)	5.15 (5.57)	10.5 (11.1)	46.6 (47.6)	13.9 (14.3)	5.11 (5.56)	25.3 (25.4)
	1.0	27.1 (27.3)	9.04 (9.48)	3.83 (4.31)	7.96 (8.47)	38.4 (39.1)	10.6 (11.1)	3.64 (4.11)	18.8 (19.4)
	1.2	20.7 (21.3)	7.01 (7.48)	2.88 (3.36)	6.17 (6.71)	33.7 (34.1)	8.36 (8.74)	2.79 (3.27)	14.5 (15.2)
	1.4	16.9 (17.4)	5.57 (6.14)	2.32 (2.78)	5.07 (5.58)	28.5 (29.0)	6.80 (7.19)	2.20 (2.67)	11.8 (12.3)
	1.6	13.8 (14.2)	4.68 (5.12)	1.87 (2.33)	4.16 (4.65)	25.5 (25.4)	5.93 (6.46)	1.73 (2.14)	9.72 (10.2)
	1.8	11.3 (11.6)	3.82 (4.29)	1.52 (1.95)	3.46 (4.06)	22.2 (22.8)	4.81 (5.31)	1.40 (1.82)	8.08 (8.57)
	2.0	9.71 (10.2)	3.29 (3.75)	1.29 (1.69)	2.95 (3.40)	19.7 (20.1)	4.13 (4.61)	1.17 (1.60)	6.81 (7.35)
Σ_{OC_2}	0.6	55.7 (56.3)	27.9 (28.2)	25.2 (25.6)	18.2 (18.5)	135 (134)	97.1 (97.0)	79.1 (79.2)	41.6 (41.6)
	0.8	40.7 (41.1)	20.2 (21.0)	18.9 (19.8)	12.5 (13.1)	125 (123)	81.8 (83.4)	66.6 (67.5)	28.0 (28.3)
	1.0	32.3 (32.7)	15.4 (15.8)	14.6 (15.0)	9.25 (9.59)	116 (117)	72.8 (73.0)	57.5 (57.9)	20.3 (20.8)
	1.2	25.6 (25.6)	12.0 (12.3)	11.9 (12.5)	7.20 (7.70)	104 (105)	66.1 (65.8)	50.4 (50.8)	15.4 (15.9)
	1.4	20.9 (21.8)	9.84 (10.3)	9.57 (10.2)	5.90 (6.46)	96.4 (95.5)	58.2 (59.8)	44.7 (45.4)	12.2 (12.8)
	1.6	17.5 (18.0)	8.30 (8.84)	8.52 (8.67)	4.84 (5.25)	92.2 (91.8)	52.6 (53.3)	39.8 (39.9)	9.79 (10.2)
	1.8	14.7 (15.2)	7.09 (7.55)	7.05 (7.59)	4.07 (4.55)	84.7 (85.0)	47.7 (48.2)	35.4 (35.8)	8.06 (8.71)
	2.0	12.9 (13.2)	5.97 (6.51)	6.06 (6.44)	3.43 (3.89)	80.7 (81.7)	43.8 (44.1)	32.3 (33.0)	6.78 (7.33)
Σ_{OC_3}	0.6	63.4 (62.9)	75.4 (75.4)	189 (192)	108 (109)	166 (165)	168 (168)	195 (197)	197 (195)
	0.8	46.9 (46.1)	57.1 (58.0)	185 (183)	89.3 (89.6)	160 (156)	162 (165)	202 (200)	194 (194)
	1.0	35.4 (36.1)	46.7 (46.7)	183 (181)	73.4 (74.1)	153 (151)	150 (152)	200 (201)	192 (194)
	1.2	27.9 (28.5)	36.2 (36.7)	178 (178)	62.1 (62.4)	144 (143)	142 (145)	195 (197)	190 (190)
	1.4	22.5 (22.8)	30.1 (30.3)	174 (173)	50.8 (51.4)	133 (131)	131 (132)	197 (201)	190 (191)
	1.6	18.6 (19.3)	25.0 (25.0)	170 (169)	42.4 (42.4)	128 (127)	127 (129)	195 (195)	188 (191)
	1.8	15.4 (16.0)	21.2 (21.5)	170 (170)	37.2 (37.5)	120 (120)	120 (120)	196 (195)	187 (186)
	2.0	13.2 (13.9)	17.8 (18.0)	164 (166)	31.8 (32.2)	118 (119)	114 (116)	193 (193)	183 (183)
Σ_{OC_4}	0.6	61.9 (63.4)	71.4 (72.9)	190 (195)	120 (122)	165 (165)	167 (167)	199 (199)	192 (196)
	0.8	45.6 (46.5)	52.6 (53.1)	185 (187)	101 (101)	152 (150)	155 (159)	198 (197)	189 (185)
	1.0	33.4 (33.4)	38.5 (38.5)	181 (181)	84.4 (85.8)	144 (147)	143 (142)	198 (197)	187 (184)
	1.2	26.0 (26.3)	30.1 (30.6)	179 (178)	72.0 (72.5)	137 (139)	129 (128)	197 (196)	183 (179)
	1.4	19.7 (20.3)	23.5 (23.8)	176 (174)	58.3 (58.9)	128 (130)	121 (119)	197 (196)	175 (174)
	1.6	15.9 (16.5)	18.7 (19.2)	172 (173)	50.7 (50.9)	121 (123)	113 (113)	195 (196)	166 (167)
	1.8	12.5 (13.0)	15.3 (16.1)	168 (170)	44.4 (44.7)	112 (112)	104 (105)	195 (194)	159 (158)
	2.0	10.2 (10.9)	12.2 (12.8)	163 (165)	38.1 (37.9)	104 (105)	95.3 (95.2)	194 (195)	150 (150)

Table 16. ARL_1 (STD) comparison between the PLR chart and the modified MaxNorm chart for Σ_{OC_j} , $j \in \{5, 6, 7\}$, when $n = 50$.

$p = 5$					$p = 30$				
Δ	PLR with ρ			M-MaxNorm	PLR with ρ			M-MaxNorm	
	0.05	0.20	1.00		0.05	0.20	1.00		
Σ_{OC_5}									
0.6	56.4 (55.9)	35.1 (35.0)	33.0 (33.6)	35.3 (35.6)	134 (135)	102 (102)	90.3 (90.2)	116 (117)	
0.8	43.0 (43.7)	26.1 (26.7)	25.7 (26.2)	26.3 (26.7)	125 (126)	90.9 (92.4)	77.8 (77.0)	100 (102)	
1.0	32.9 (33.0)	19.7 (20.4)	20.7 (21.0)	20.3 (20.8)	116 (116)	80.5 (81.5)	69.6 (70.9)	86.9 (87.0)	
1.2	26.0 (26.3)	15.8 (16.5)	17.5 (17.7)	16.5 (17.0)	107 (108)	71.5 (71.2)	62.4 (63.2)	77.1 (79.9)	
1.4	21.3 (21.7)	12.8 (13.4)	14.9 (15.3)	13.6 (13.9)	99.7 (101)	64.9 (64.2)	57.2 (57.7)	67.1 (68.1)	
1.6	18.0 (18.7)	10.9 (11.6)	13.0 (13.5)	11.5 (12.0)	92.7 (93.1)	58.2 (58.4)	51.8 (52.2)	60.5 (61.1)	
1.8	15.3 (15.9)	9.17 (9.56)	11.3 (11.7)	9.71 (9.98)	87.0 (86.4)	53.2 (53.4)	48.6 (48.9)	53.8 (54.1)	
2.0	12.9 (13.2)	7.82 (8.27)	10.1 (10.4)	8.40 (8.79)	81.8 (82.2)	49.3 (50.5)	45.0 (45.0)	49.7 (50.4)	
Σ_{OC_6}									
0.6	62.1 (62.9)	54.9 (55.0)	110 (110)	78.8 (80.9)	196 (197)	163 (162)	144 (144)	175 (175)	
0.8	44.8 (45.4)	39.9 (40.3)	91.4 (92.3)	59.8 (60.8)	181 (180)	148 (148)	130 (131)	164 (166)	
1.0	33.9 (34.4)	30.0 (30.3)	77.0 (76.9)	46.4 (46.2)	169 (168)	132 (133)	125 (125)	154 (157)	
1.2	27.5 (28.1)	22.1 (22.7)	64.6 (65.3)	36.1 (37.0)	153 (154)	121 (121)	112 (112)	136 (136)	
1.4	21.7 (22.4)	17.7 (18.2)	53.9 (54.4)	28.7 (29.0)	146 (147)	113 (114)	104 (105)	124 (125)	
1.6	17.7 (18.2)	14.4 (14.9)	46.8 (47.5)	23.3 (23.3)	133 (133)	102 (101)	98.1 (98.5)	111 (111)	
1.8	14.9 (15.5)	12.0 (12.5)	41.1 (41.5)	19.1 (19.2)	121 (122)	93.4 (93.5)	86.5 (86.4)	98.3 (99.6)	
2.0	12.5 (13.1)	9.88 (10.3)	35.1 (35.6)	16.2 (16.7)	112 (111)	81.7 (81.9)	73.2 (73.3)	88.3 (88.9)	
Σ_{OC_7}									
0.6	52.7 (52.8)	28.1 (28.4)	18.9 (19.5)	25.6 (26.0)	125 (125)	85.5 (85.9)	65.0 (65.9)	92.2 (91.1)	
0.8	39.8 (40.3)	20.5 (21.2)	14.2 (14.7)	19.5 (20.2)	112 (114)	72.6 (55.3)	55.6 (55.3)	77.2 (77.8)	
1.0	30.8 (31.1)	15.6 (16.1)	11.0 (11.4)	15.0 (15.6)	101 (102)	62.6 (49.3)	48.3 (49.3)	66.1 (66.3)	
1.2	24.5 (25.1)	12.2 (12.7)	9.14 (9.62)	12.1 (12.6)	93.4 (93.1)	54.7 (42.0)	42.1 (42.0)	56.5 (56.6)	
1.4	19.6 (19.9)	9.92 (10.5)	7.27 (7.83)	9.98 (10.4)	85.7 (86.8)	48.6 (37.5)	36.9 (37.5)	50.0 (50.8)	
1.6	15.9 (16.0)	8.36 (8.76)	6.27 (6.71)	8.25 (8.72)	80.0 (80.5)	43.2 (33.3)	32.9 (33.3)	43.0 (43.6)	
1.8	13.5 (13.9)	7.06 (7.57)	5.35 (5.88)	7.05 (7.40)	74.7 (76.2)	39.5 (30.5)	29.8 (30.5)	38.1 (38.1)	
2.0	11.6 (12.0)	5.91 (6.33)	4.69 (5.22)	6.15 (6.65)	69.4 (70.3)	35.0 (27.3)	26.8 (27.3)	33.6 (34.4)	

Table 17. ARL_1 (STD) comparison under various λ 's for the MEWMC-based PLR chart, the HMT chart and the MaxNorm chart for Σ_{OC_j} , $j \in \{1, 2\}$, when $p = 10$ and $n = 20$.

		$\lambda = 0.1$				$\lambda = 0.2$				$\lambda = 0.3$						
	Δ	MEWMC-based		PLR with ρ	HMT	MaxNorm	MEWMC-based		PLR with ρ	HMT	MaxNorm	MEWMC-based		PLR with ρ	HMT	MaxNorm
		0.05	0.20	1.00			0.05	0.20	1.00			0.05	0.20	1.00		
Σ_{OC_1}																
	0.6	55.0 (43.8)	16.6 (10.9)	2.42 (2.09)	27.9 (16.9)	26.5 (18.0)	56.6 (50.9)	18.7 (15.3)	3.38 (3.36)	26.9 (21.5)	16.7 (13.4)	60.9 (57.8)	19.2 (16.9)	4.34 (4.10)	35.4 (32.2)	15.5 (13.8)
	0.8	36.7 (25.8)	12.2 (7.36)	2.02 (1.53)	20.9 (11.1)	19.4 (11.8)	39.0 (33.8)	13.3 (9.95)	2.52 (2.48)	19.8 (14.9)	12.6 (9.28)	42.7 (39.1)	13.8 (11.5)	3.19 (2.98)	25.7 (22.8)	11.7 (9.95)
	1.0	26.4 (16.1)	8.22 (5.33)	1.80 (1.27)	16.9 (7.93)	15.3 (8.40)	28.7 (24.0)	10.1 (7.05)	2.04 (1.97)	15.6 (10.9)	10.1 (7.17)	33.0 (30.3)	10.6 (8.51)	2.64 (2.48)	20.0 (17.1)	9.25 (7.45)
	1.2	21.2 (11.8)	8.22 (4.26)	1.66 (1.05)	14.6 (6.35)	13.1 (6.84)	22.6 (17.7)	8.19 (5.38)	1.70 (1.70)	13.0 (8.57)	8.50 (5.64)	25.6 (22.5)	8.52 (6.57)	2.16 (2.06)	16.2 (13.7)	7.79 (6.18)
	1.4	17.8 (9.10)	7.14 (3.51)	1.55 (0.95)	12.9 (5.21)	11.4 (5.46)	18.2 (13.5)	7.06 (4.51)	1.46 (1.48)	11.1 (6.94)	7.37 (4.61)	21.2 (18.7)	7.14 (5.32)	1.82 (1.74)	13.1 (10.3)	6.52 (5.01)
	1.6	15.4 (7.34)	6.33 (2.97)	1.46 (0.84)	11.6 (4.46)	10.1 (4.67)	15.0 (10.8)	6.10 (3.74)	1.27 (1.30)	9.78 (5.84)	6.54 (4.00)	17.4 (14.5)	6.17 (4.45)	1.61 (1.55)	11.4 (8.87)	5.74 (4.28)
	1.8	13.7 (6.16)	5.77 (2.64)	1.38 (0.73)	10.6 (3.85)	9.11 (3.99)	12.9 (8.66)	5.47 (3.24)	1.11 (1.17)	8.80 (5.04)	5.84 (3.50)	14.4 (11.8)	5.37 (3.75)	1.42 (1.67)	9.89 (7.46)	5.07 (3.71)
	2.0	12.2 (5.10)	5.28 (2.32)	1.33 (0.66)	9.83 (3.46)	8.33 (3.48)	11.3 (7.34)	4.92 (2.81)	1.00 (1.07)	7.91 (4.34)	5.39 (3.12)	12.6 (10.1)	4.83 (3.29)	1.25 (1.26)	6.69 (6.27)	4.61 (3.29)
Σ_{OC_2}																
	0.6	32.1 (19.6)	16.4 (9.42)	9.62 (13.6)	34.3 (21.6)	14.2 (8.75)	40.4 (33.2)	17.8 (13.5)	17.7 (18.5)	34.6 (26.7)	12.5 (9.50)	50.7 (47.0)	22.6 (20.0)	22.4 (22.6)	45.4 (42.1)	13.3 (11.6)
	0.8	24.9 (13.5)	12.9 (6.96)	7.34 (10.4)	26.1 (15.1)	11.0 (6.28)	30.2 (23.2)	13.7 (9.85)	13.7 (14.0)	26.0 (19.8)	9.46 (6.95)	38.1 (33.5)	16.1 (13.3)	17.2 (17.1)	34.4 (30.4)	9.68 (8.13)
	1.0	20.8 (10.4)	10.9 (5.56)	5.91 (8.11)	21.5 (11.2)	9.28 (5.19)	24.3 (17.9)	11.0 (7.41)	11.0 (11.2)	20.8 (15.2)	7.49 (5.47)	30.0 (26.0)	13.0 (10.2)	13.4 (13.3)	27.3 (23.4)	7.86 (6.47)
	1.2	18.0 (8.37)	9.56 (4.57)	4.89 (6.86)	18.3 (8.91)	7.90 (4.23)	20.0 (14.3)	9.31 (6.12)	9.03 (9.00)	17.6 (12.4)	6.41 (4.48)	24.6 (20.5)	10.9 (8.33)	11.3 (11.0)	22.4 (18.7)	6.58 (5.28)
	1.4	15.9 (7.06)	8.53 (4.04)	4.30 (5.83)	16.3 (7.29)	7.02 (3.75)	17.0 (11.3)	8.14 (5.05)	7.80 (7.66)	14.9 (9.91)	5.58 (3.78)	20.7 (17.0)	9.21 (6.90)	9.71 (9.27)	18.8 (15.1)	5.67 (4.51)
	1.6	14.4 (5.90)	7.78 (3.63)	3.69 (4.91)	14.9 (6.34)	6.34 (3.31)	14.9 (9.63)	7.28 (4.39)	6.95 (6.74)	13.3 (8.54)	4.99 (3.39)	17.6 (13.9)	8.23 (6.12)	8.44 (7.93)	16.4 (13.0)	4.85 (3.73)
	1.8	13.2 (5.33)	7.17 (3.31)	3.38 (4.47)	13.6 (5.62)	5.81 (3.03)	13.4 (8.32)	6.58 (3.93)	6.08 (5.73)	12.0 (7.27)	4.54 (3.06)	15.8 (12.1)	7.24 (5.13)	7.43 (7.03)	14.4 (11.2)	4.40 (3.43)
	2.0	12.4 (4.91)	6.64 (2.99)	2.97 (3.88)	12.6 (4.92)	5.32 (2.76)	12.1 (7.23)	5.96 (3.50)	5.48 (5.15)	11.0 (6.46)	4.11 (2.71)	13.8 (10.4)	6.49 (4.60)	6.69 (6.26)	12.8 (9.60)	4.02 (3.07)

Table 18. ARL_1 (STD) comparison under various λ 's for the MEWMC-based PLR chart, the HMT chart and the MaxNorm chart for Σ_{OC_j} , $j \in \{3, 4\}$, when $p = 10$ and $n = 20$.

$\lambda = 0.1$						$\lambda = 0.2$					$\lambda = 0.3$					
Δ	MEWMC-based PLR with ρ			HMT	MaxNorm	MEWMC-based PLR with ρ			HMT	MaxNorm	MEWMC-based PLR with ρ			HMT	MaxNorm	
	0.05	0.20	1.00			0.05	0.20	1.00			0.05	0.20	1.00			
Σ_{OC_3}																
0.6	27.4 (14.3)	177 (161)	189 (257)	33.2 (20.0)	39.4 (24.3)	33.6 (25.3)	108 (101)	194 (208)	34.6 (28.0)	56.6 (49.4)	45.5 (40.4)	86.1 (82.4)	190 (193)	48.3 (44.3)	88.8 (85.8)	
0.8	21.8 (9.81)	155 (139)	196 (265)	25.3 (13.5)	29.3 (15.7)	24.7 (17.8)	84.8 (77.3)	193 (201)	25.7 (19.2)	40.9 (33.8)	32.7 (28.1)	64.6 (59.7)	184 (187)	35.0 (31.1)	66.8 (64.1)	
1.0	18.4 (7.46)	133 (116)	189 (257)	20.5 (9.54)	23.9 (11.1)	19.9 (12.9)	65.6 (57.0)	189 (202)	20.0 (13.8)	30.7 (23.8)	25.5 (20.8)	50.8 (46.7)	189 (193)	27.3 (23.3)	51.1 (48.0)	
1.2	16.1 (6.00)	110 (92.9)	186 (250)	18.0 (7.80)	20.4 (8.84)	16.2 (10.0)	51.6 (43.8)	185 (196)	17.1 (11.2)	24.6 (18.1)	20.7 (16.0)	40.6 (36.1)	182 (185)	21.7 (17.4)	40.0 (35.7)	
1.4	14.5 (5.04)	88.0 (70.6)	189 (254)	15.7 (6.23)	18.0 (7.29)	14.1 (8.04)	41.1 (34.1)	186 (195)	14.6 (8.86)	20.4 (14.3)	17.1 (12.9)	32.9 (28.9)	178 (184)	18.3 (14.0)	32.9 (29.2)	
1.6	13.3 (4.41)	72.2 (54.5)	176 (242)	14.2 (5.24)	16.2 (6.13)	12.5 (6.67)	33.9 (26.7)	178 (189)	12.7 (7.37)	17.3 (11.6)	14.7 (10.5)	27.2 (23.1)	186 (183)	15.6 (11.7)	27.1 (23.9)	
1.8	12.3 (3.91)	59.2 (41.6)	182 (248)	13.2 (4.62)	14.9 (5.38)	11.2 (5.66)	28.9 (21.5)	180 (190)	11.4 (6.21)	15.0 (9.34)	12.7 (8.65)	23.2 (19.3)	175 (179)	13.8 (9.95)	22.9 (19.2)	
2.0	11.5 (3.54)	49.9 (32.8)	180 (248)	12.2 (4.08)	13.7 (4.73)	10.3 (5.08)	24.9 (18.0)	179 (188)	10.4 (5.32)	13.4 (8.07)	11.4 (7.45)	19.9 (15.8)	175 (176)	12.0 (8.20)	19.6 (15.9)	
Σ_{OC_4}																
0.6	23.3 (10.3)	36.8 (22.1)	198 (270)	28.5 (15.2)	24.1 (12.2)	29.3 (21.1)	35.7 (28.2)	193 (202)	29.3 (22.3)	35.7 (29.5)	40.7 (35.1)	45.0 (40.2)	192 (196)	41.6 (36.4)	65.0 (61.1)	
0.8	18.5 (6.86)	25.0 (12.0)	188 (260)	21.6 (9.60)	17.8 (7.85)	20.8 (13.6)	23.3 (16.6)	191 (202)	21.5 (14.6)	22.3 (16.2)	28.2 (23.6)	29.4 (24.6)	186 (188)	28.7 (24.0)	41.1 (37.1)	
1.0	15.5 (5.04)	19.2 (7.88)	192 (260)	17.7 (6.68)	14.2 (5.66)	16.1 (9.21)	16.9 (10.5)	189 (201)	16.5 (10.1)	16.2 (10.6)	20.9 (16.0)	21.0 (16.6)	184 (190)	21.3 (16.9)	27.4 (23.5)	
1.2	13.5 (3.93)	15.9 (5.85)	187 (257)	15.2 (5.14)	11.8 (4.28)	13.2 (6.67)	13.2 (7.26)	188 (201)	13.4 (7.28)	12.3 (7.28)	20.9 (11.6)	21.0 (11.3)	157 (186)	16.8 (12.4)	19.7 (16.2)	
1.4	12.2 (3.24)	13.7 (4.42)	181 (244)	13.5 (4.11)	10.4 (3.58)	11.3 (5.23)	10.9 (5.46)	186 (199)	11.4 (5.66)	10.4 (5.73)	13.2 (8.83)	12.3 (8.38)	179 (179)	13.4 (9.10)	15.1 (11.6)	
1.6	11.1 (2.77)	12.1 (3.70)	182 (248)	12.1 (3.38)	9.29 (3.08)	9.95 (4.17)	9.37 (2.30)	181 (191)	9.94 (4.43)	8.79 (4.49)	11.2 (6.86)	10.1 (6.48)	183 (189)	11.4 (7.23)	12.0 (8.71)	
1.8	10.2 (2.37)	11.0 (3.16)	181 (249)	11.1 (2.83)	8.44 (2.74)	8.90 (3.45)	8.18 (3.48)	181 (193)	8.97 (3.70)	7.70 (3.74)	9.47 (5.21)	8.64 (5.07)	177 (181)	9.76 (5.65)	9.94 (6.78)	
2.0	9.54 (2.11)	10.0 (2.74)	176 (240)	10.4 (2.51)	7.68 (2.38)	8.05 (2.90)	7.36 (2.94)	177 (187)	8.09 (3.07)	6.90 (3.28)	8.45 (4.43)	7.51 (4.17)	174 (174)	8.55 (4.70)	8.59 (5.56)	

Table 19. ARL₁ (STD) comparison under various λ 's for the MEWMC-based PLR chart, the HMT chart and the MaxNorm chart for Σ_{OC_j} , $j \in \{5, 6\}$, when $p = 10$ and $n = 20$.

		$\lambda = 0.1$				$\lambda = 0.2$				$\lambda = 0.3$						
	Δ	MEWMC-based PLR with ρ			HMT	MaxNorm	MEWMC-based PLR with ρ			HMT	MaxNorm	MEWMC-based PLR with ρ			HMT	MaxNorm
		0.05	0.20	1.00			0.05	0.20	1.00			0.05	0.20	1.00		
Σ_{OC_5}																
	0.6	34.3 (21.5)	41.4 (31.1)	12.2 (18.7)	33.8 (21.5)	32.7 (21.6)	42.5 (35.8)	38.2 (32.7)	23.3 (25.1)	34.8 (28.9)	29.4 (24.5)	52.9 (49.6)	37.9 (34.8)	30.1 (31.1)	45.4 (41.2)	34.4 (32.2)
	0.8	26.3 (14.6)	30.5 (21.0)	9.36 (14.2)	25.8 (14.5)	24.4 (14.5)	30.8 (23.9)	26.9 (21.6)	17.9 (19.2)	26.1 (20.5)	21.7 (17.2)	39.4 (35.2)	27.1 (24.1)	23.6 (24.1)	34.1 (30.0)	25.0 (22.5)
	1.0	21.6 (11.0)	24.1 (15.4)	7.58 (11.4)	21.2 (10.9)	20.0 (10.9)	24.6 (18.3)	20.7 (16.0)	15.1 (15.9)	21.0 (15.6)	17.6 (13.4)	31.5 (27.5)	21.1 (18.0)	19.3 (19.5)	27.5 (23.9)	20.1 (17.6)
	1.2	18.6 (8.92)	19.9 (11.9)	6.31 (9.39)	18.4 (8.70)	17.1 (8.81)	20.6 (14.3)	17.2 (12.8)	12.7 (13.4)	17.7 (12.3)	14.6 (10.5)	25.3 (21.4)	17.0 (14.2)	16.1 (16.3)	22.4 (18.9)	16.4 (13.9)
	1.4	16.6 (7.48)	17.2 (9.74)	5.44 (8.14)	16.3 (7.35)	15.0 (7.28)	17.5 (12.0)	14.5 (10.2)	10.9 (11.3)	15.2 (10.2)	12.4 (8.69)	20.9 (17.6)	14.1 (11.5)	14.1 (14.1)	18.9 (15.3)	13.8 (11.7)
	1.6	15.1 (6.52)	15.3 (8.04)	4.81 (7.05)	14.8 (6.29)	13.5 (6.21)	15.2 (9.56)	12.4 (8.37)	9.78 (10.2)	13.3 (8.65)	11.0 (7.34)	18.2 (14.3)	12.2 (9.50)	12.4 (12.3)	16.4 (13.1)	11.9 (9.69)
	1.8	13.6 (5.51)	13.8 (7.15)	4.31 (6.18)	13.5 (5.57)	12.4 (5.50)	13.6 (8.48)	10.9 (7.22)	8.54 (8.63)	11.9 (7.14)	9.83 (6.33)	15.9 (12.4)	10.8 (8.27)	11.1 (10.9)	14.3 (10.9)	10.6 (8.45)
	2.0	12.7 (5.03)	12.5 (6.30)	3.79 (5.43)	12.5 (4.88)	11.4 (4.90)	12.2 (7.48)	9.94 (6.31)	7.65 (7.73)	10.9 (6.37)	8.99 (5.72)	14.1 (10.7)	9.53 (7.21)	9.96 (9.67)	12.9 (9.71)	9.31 (7.27)
Σ_{OC_6}																
	0.6	26.8 (13.8)	37.9 (24.2)	58.9 (89.2)	31.4 (18.4)	25.7 (14.6)	33.8 (26.6)	35.0 (28.7)	83.1 (89.7)	32.9 (26.4)	32.8 (26.8)	45.6 (41.2)	41.3 (37.7)	92.7 (93.9)	44.9 (40.8)	50.9 (48.2)
	0.8	21.5 (9.72)	26.3 (14.7)	42.6 (62.8)	24.0 (12.1)	19.0 (9.30)	25.8 (18.4)	24.0 (17.8)	64.9 (70.1)	24.1 (17.6)	21.8 (16.4)	34.1 (29.7)	27.9 (24.5)	73.8 (75.2)	32.5 (28.4)	33.1 (29.8)
	1.0	17.9 (7.22)	20.4 (10.4)	31.5 (47.7)	19.9 (9.15)	15.3 (6.81)	20.3 (13.8)	17.9 (12.6)	50.5 (54.1)	19.2 (12.9)	16.3 (11.2)	26.2 (21.4)	20.7 (17.2)	59.7 (60.9)	25.3 (21.1)	23.6 (20.4)
	1.2	16.0 (6.25)	16.8 (7.91)	24.6 (36.8)	17.3 (7.28)	13.1 (5.62)	16.9 (10.6)	14.4 (9.51)	41.5 (44.3)	16.2 (10.5)	13.2 (8.51)	21.6 (17.0)	16.1 (12.9)	49.0 (50.0)	20.8 (17.1)	18.1 (15.2)
	1.4	14.5 (5.33)	14.4 (6.52)	19.5 (30.1)	15.4 (6.08)	11.5 (4.63)	14.8 (8.88)	12.1 (7.45)	33.9 (35.9)	14.0 (8.55)	11.0 (6.73)	18.0 (13.6)	13.3 (10.2)	40.9 (41.9)	17.2 (13.4)	14.4 (11.5)
	1.6	13.2 (4.59)	12.8 (5.46)	15.2 (23.3)	14.1 (5.31)	10.4 (4.08)	13.2 (7.71)	10.5 (6.28)	27.9 (30.3)	12.4 (7.22)	9.52 (5.63)	15.6 (11.6)	11.2 (8.40)	34.2 (35.3)	15.0 (11.3)	11.9 (9.24)
	1.8	12.3 (4.19)	11.7 (4.89)	12.9 (19.4)	13.0 (4.78)	9.51 (3.63)	11.9 (6.44)	9.40 (5.40)	23.7 (25.1)	11.2 (6.14)	8.49 (4.81)	13.8 (9.88)	9.84 (7.22)	29.1 (29.6)	13.3 (9.69)	10.2 (7.64)
	2.0	11.5 (3.83)	10.6 (4.29)	10.7 (16.1)	12.1 (4.26)	8.83 (3.36)	10.8 (5.68)	8.38 (4.71)	19.9 (21.2)	10.3 (5.49)	7.73 (4.29)	12.3 (8.62)	8.65 (5.96)	25.5 (26.1)	11.9 (8.39)	8.89 (6.52)

Table 20. ARL_1 (STD) comparison under various λ 's for the MEWMC-based PLR chart, the HMT chart and the MaxNorm chart for Σ_{OC_j} , $j = 7$, when $p = 10$ and $n = 20$.

$\lambda = 0.1$						$\lambda = 0.2$						$\lambda = 0.3$				
Δ	MEWMC-based PLR with ρ			HMT	MaxNorm	MEWMC-based PLR with ρ			HMT	MaxNorm	MEWMC-based PLR with ρ			HMT	MaxNorm	
	0.05	0.20	1.00			0.05	0.20	1.00			0.05	0.20	1.00			
Σ_{OC_7}	0.6	36.1	30.5	6.53	31.9	30.4	44.2	29.9	13.5	32.0	25.0	53.3	31.4	17.6	42.2	26.8
		(23.0)	(21.7)	(9.72)	(19.7)	(19.6)	(37.2)	(25.0)	(14.5)	(26.3)	(20.8)	(48.7)	(28.2)	(17.6)	(38.7)	(24.8)
	0.8	26.8	22.4	5.00	24.1	22.4	31.7	21.4	10.5	23.9	18.5	38.7	22.5	13.3	32.3	20.1
		(15.3)	(14.6)	(7.58)	(13.2)	(13.2)	(25.5)	(17.1)	(10.9)	(18.2)	(14.5)	(34.7)	(20.0)	(13.5)	(28.3)	(17.6)
	1.0	21.7	17.8	3.96	19.9	18.2	24.7	16.6	8.33	19.2	14.8	30.4	17.4	10.7	25.1	15.8
		(11.1)	(10.7)	(5.83)	(9.95)	(9.73)	(18.6)	(12.3)	(8.46)	(13.8)	(10.9)	(26.3)	(14.6)	(10.5)	(21.3)	(13.7)
	1.2	18.6	14.9	3.32	17.2	15.5	20.0	13.5	7.03	16.0	12.3	24.5	14.0	9.11	20.4	13.0
		(8.74)	(8.27)	(4.78)	(7.90)	(7.75)	(14.2)	(9.44)	(7.15)	(10.6)	(8.78)	(20.7)	(11.4)	(9.09)	(16.8)	(10.9)
	1.4	16.2	13.0	2.83	15.1	13.7	16.8	11.4	6.07	13.7	10.6	20.4	11.9	7.69	16.9	10.9
		(7.05)	(6.87)	(4.07)	(6.40)	(6.58)	(11.4)	(7.66)	(6.09)	(8.81)	(7.07)	(16.9)	(9.17)	(7.40)	(13.5)	(8.94)
	1.6	14.6	11.5	2.41	13.7	12.2	14.5	10.0	5.30	12.1	9.30	17.4	10.1	6.77	14.6	9.51
		(6.04)	(5.84)	(3.45)	(5.60)	(5.55)	(9.15)	(6.51)	(5.25)	(7.37)	(5.99)	(14.0)	(7.64)	(6.41)	(11.5)	(7.46)
1.8	13.3	10.4	2.25	12.6	11.1	13.1	8.87	4.78	10.8	8.38	15.0	8.83	6.00	12.7	8.43	
	(5.22)	(5.04)	(3.18)	(4.84)	(4.92)	(8.02)	(5.61)	(4.67)	(6.29)	(5.19)	(11.4)	(6.57)	(5.63)	(9.53)	(6.31)	
2.0	12.2	9.53	1.96	11.7	10.3	11.7	7.99	4.26	9.91	7.57	13.2	7.91	5.32	11.5	7.57	
	(4.65)	(4.54)	(2.77)	(4.27)	(4.40)	(6.83)	(4.75)	(4.04)	(5.62)	(4.60)	(9.87)	(5.69)	(5.07)	(8.43)	(5.70)	