SPAN Margin Examples
ASX Equity Options

An example of the SPAN calculation is provided in the following sections. The example is based on a hypothetical portfolio of equity options and set of margin rate assumptions (Appendix I). The example illustrates in detail each of the major SPAN calculations applicable to equity options, including the scan risk, intercommodity spread credit and short option minimum.

SPAN evaluates the basis risk between contract periods with different expirations within the same product. Given the nature of a portfolio consisting solely of equity option contracts as outlined in the sample portfolio in Appendix I, intra-commodity spread charges do not apply. This is because the intracommodity spread charge is based on equivalent units in the underlying equity, where the equity does not have an expiration date. It should be noted however that if a portfolio were to consist of a combination of low exercise price options (LEPO) and ordinary options on the same equity, that an intracommodity spread charge may apply. This is because the LEPO is treated like a futures contract in SPAN, so that a series of LEPOs on the same equity will have different expirations and potentially varying levels of risk for each expiry.

The delivery risk charge is used to account for risk associated with positions in physically-deliverable products as they approach or enter their delivery period. Given the nature of a portfolio consisting solely of equity option contracts, as outlined by the sample portfolio in Appendix I, delivery risk does not apply. This is because delivery risk is based on equivalent units in the underlying equity, where the equity does not have an expiration date.

It should be noted that the example does not demonstrate all SPAN functionality (e.g. the application of scanning based intercommodity spread credits, etc.). However, the example demonstrates the functionality appropriate for margining ASX Clear equity options.

Note: the conventions relating to currency and rounding demonstrated in this example may differ to the conventions used by ASX in determining actual margin requirements.

SPAN Margin Example - Scan Risk

SPAN risk arrays represent a contract's hypothetical gain/loss, under a specific set of market conditions, from a set point in time to a specific point in time in the future. Risk arrays typically consist of 16 profit/loss scenarios for each contract. The standard SPAN risk array structure, also used by ASX Clear, is outlined in Appendix II.

Each risk array scenario is comprised of a different market simulation, moving the underlying price up or down and / or moving volatility up or down. The risk array representing the maximum likely loss becomes the scan risk for the portfolio.

A sample set of margin rates, and a portfolio, are provided in Appendix I. These are used here to illustrate the calculation of scan risk.

The results from applying the 16 profit and loss scenarios are summarised below and also provided in detail in Appendix II.

Combined Commodity	Volatility Risk	Upside Price Risk	Downside Price Risk	Worst Case
BHP	$0.58 cr	$283.23 dr	$76.42 cr	$283.23 dr (scenario 11)
RIO	$1.08 dr	$313.07 dr	$95.29 cr	$313.07 dr (scenario 11)
CBA	$2.00 dr	$107.61 cr	$306.65 dr	$306.65 dr (scenario 13)

The largest loss for both BHP and RIO combined commodities is based on the market scenario where the underlying price increases by the full price scanning range (BHP and RIO equity prices increase by 6%), the volatility increases by the full volatility scanning range (implied volatility of BHP and RIO options increase by 2%) and time to expiry of the BHP and RIO options decrease by 2 days.

The largest loss for CBA on the other hand is based on the market simulation where the underlying price decreases by the full price scanning range (CBA equity price decreases by 3%), the volatility decreases by the full volatility scanning range (implied volatility of CBA option decreases by 2%) and time to expiry of the CBA option decreases by 2 days.

Combined Commodity	Scan Risk
BHP	$283.23 dr
RIO	$313.07 dr
CBA	$306.65 dr

The above scan risk estimates represent the maximum likely loss over 2 days for each combined commodity. The scan risk at this stage does not account for any possible offsets between these combined commodities and, if appropriate, will be reflected by a concession in the calculation of the intercommodity spread credit.

SPAN Margin Example - Intercommodity Spread Credit

SPAN evaluates whether a credit is applicable for positions in related instruments. The calculation of the delta based[1] intercommodity spread credit considers the weighted futures price risk (WFPR), delta per spread ratio (DPSR), number of spreads formed and the concession rate.

An example, based on the portfolio and margin rates provided in Appendix I, is outlined below. A summary of the net delta and weighted futures price risk is provided here, with further detail of these calculations provided in Appendices IV and V respectively.

Combined Commodity	Net Delta	WFPR
BHP	-1.23630	$230.88
RIO	-0.8668	$360.14
CBA	1.9919	$153.96

[1]SPAN provides two approaches in calculating intercommodity spread credits: 1) delta based

The concessions are provided in priority order as defined in Appendix I and once net delta has been used to form spreads in a higher priority order concession, the net delta is no longer available to form other spreads in lower priority order concessions. Note that the priority of spreads will typically be ordered so that spreads with the largest concessions are given the highest priority. The concession can be calculated as:

WFPR x Number of spreads formed x DPSR x concession rate

Spread Priority 1

Starting with the first priority concession in Appendix I, spreads between BHP and RIO will receive a 55% concession. The concession definition requires net delta of BHP and RIO to be on opposite sides (i.e. long BHP and short RIO or short BHP and long RIO). However given that the net delta for BHP and RIO are both net short (referring to the table above, BHP net delta is -1.23630 and RIO net delta is -0.8668) no spreads are formed for this spread and therefore no concession is available.

Priority 1 BHP Concession = $230.88 x 0 x 1 x 55% = $0.00

Priority 1 RIO Concession = $360.14 x 0 x 1 x 55% = $0.00

Spread Priority 2

The second priority indicates a concession of 47% is available for spreads between BHP and CBA. As the net delta for BHP is net short -1.2363 and the net delta for CBA is net long 1.9919. There are on a 1 to 1 basis, 1.2363 spreads available for a concession.

Priority 2 BHP Concession = $230.88 x 1.2363 x 1 x 47% = $134.16

Priority 2 CBA Concession = $153.96 x 1.2363 x 1 x 47% = $89.47

Spread Priority 3

The final concession available is between CBA and RIO and offers a credit of 33%. The portfolio is net long 1.9919 CBA, however given 1.2363 net delta has already been used for the BHP and CBA spread, only 0.7556 is available for the CBA and RIO spread. As such, 0.7556 spreads are available for a concession, on 1 to 1 basis.

Priority 3 RIO Concession = $360.14 x 0.7556 x 1 x 33% = $89.80

Priority 3 CBA Concession = $153.96 x 0.7556 x 1 x 33% = $38.39

The concessions for each priority are then aggregated for each combined commodity, to arrive at concession for the combined commodity.

Combined Commodity	Concession
BHP	**$134.16**
Priority 1 Concession	$ 0.00
Priority 2 Concession	$134.16
Priority 3 Concession	$ 0.00
RIO	**$ 89.80**
Priority 1 Concession	$ 0.00
Priority 2 Concession	$ 0.00
Priority 3 Concession	$ 89.80

Combined Commodity	Concession
CBA	**$127.86**
Priority 1 Concession	$ 0.00
Priority 2 Concession	$ 89.47
Priority 3 Concession	$ 38.39

SPAN Margin Example - Short Option Minimum

Deep out-of-the-money short options may show zero or minimal scan risk given the price and volatility moves in the 16 market scenarios. However, in extreme events these options may move closer to-the-money or in-the-money, thereby generating potentially large losses. To account for this potential exposure, short option minimum can be set for each product. If the scan risk is lower than the short option minimum then the short option minimum is charged.

The short option minimum is calculated, for each combined commodity, by charging each short option the corresponding short option minimum charge. In the case of options on equities, given that short calls and short puts on the same underlying equity cannot be simultaneously deep-out-of-the-money, the maximum of the number of short put option contracts and short call option contracts is used in the calculation.

Using the portfolio and margin rates outlined in Appendix I, the number of short option contracts used in the calculation of the short option minimum is provided below.

Combined Commodity	Number of Contracts	Number of Short Calls	Number of Short Puts	Number of Short Options for SOM
BHP	**2**	**2**	**0**	**2**
BHP Aug 12 $31.50 Call	-1			
BHP Oct 12 $30.50 Call	-1			
RIO	**2**	**1**	**0**	**1**
RIO Aug 12 $56.00 Put	1			
RIO Aug 12 $58.00 Call	-1			
CBA	**3**	**0**	**2**	**2**
CBA Aug 12 $53.00 Call	1			
CBA Nov 12 $54.00 Put	-2			

The number of short option contracts for each combined commodity is then charged the short option minimum charge, to arrive at a short option minimum for each combined commodity.

Combined Commodity	Number of Short Options	Short Option Minimum Charge	Short Option Minimum
BHP	2	$0.50	$1.00
RIO	1	$0.50	$1.00*
CBA	2	$0.50	$1.00

*The short option minimum is rounded to the closest dollar in this example.

SPAN Margin Example - SPAN Requirement

The SPAN requirement consists of the scan risk, intracommodity spread charge, delivery risk, intercommodity spread credit and short option minimum. In particular the SPAN requirement is determined for each combined commodity as:

Maximum (scan risk + intracommodity spread charge + delivery risk – intercommodity spread credit, short option minimum)

Using the sample portfolio and margin rates outlined in Appendix I, the SPAN requirement for each combined commodity is summarised below. The calculation of the scan risk, intracommodity spread charge, delivery risk, inter-commodity concession and short option minimum are provided in previous sections of this document.

	BHP	RIO	CBA
SPAN Requirement	$149.07	$223.27	$178.79
Scan Risk	$283.23	$313.07	$306.65
Intracommodity Spread Charge	n/a	n/a	n/a
Delivery Risk	n/a	n/a	n/a
Intercommodity Spread Credit	$134.16	$89.80	$127.86
Short Option Minimum	$ 1.00	$ 1.00	$ 1.00

SPAN margin example – Premium Margin

The Premium Margin (or commonly referred to as available net option value) is the market value of a "premium style" option position at the point in time of the margin calculation. For example, if an option is valued at $0.35 at the close of business, the premium margin component of the total margin requirement the following day would be $35 per option contract (i.e. $0.35 * 100 underlying equities[2]).

Using the example portfolio in Appendix I, the premium margin for each contract would be calculated as follows:

Number of contracts x Option Market Price x Number of underlying equities

The premium margin for each combined commodity in the portfolio:

Combined Commodity	Current Price	Premium Margin
BHP		
Written 1 Aug 12 $31.50 call (on 100 BHP equities)	$1.07	$107.00 dr
Written 1 Oct 12 $30.50 call (on 100 BHP equities)	$2.155	$215.50 dr
Total		**$322.50 dr**
RIO		
Taken 1 Aug 12 $56.00 put (on 100 RIO equities)	$1.42	$142.00 cr
Written 1 Aug 12 $58.00 call (on 100 RIO equities)	$1.275	$127.50 dr
Total		**$14.50 cr**
CBA		
Taken 1 Aug 12 $53.00 call (on 100 CBA equities)	$0.815	$81.50 cr
Written 2 Nov 12 $54.00 put (on 100 CBA equities)	$3.12	$624.00 dr
Total		**$542.50 dr**

[2]The number of underlying shares is typically 100, however may vary due to corporate actions.

The premium margin for this portfolio:

Combined Commodity	Premium Margin

Combined Commodity	Premium Margin
BHP	$322.50 dr
RIO	$14.50 cr
CBA	$542.50 dr
Total	**$850.50 dr**

SPAN margin example - Total requirement

The SPAN requirement and premium margin for each combined commodity in an account are aggregated to arrive at the total requirement.

Note ASX allows the premium paid up front on long option positions to be used to offset the SPAN requirement on both that long option position and any other position in the same account.

Using the portfolio and margin rates outlined in Appendix I, the SPAN requirement and premium margin for each of the combined commodities in the portfolio are provided in the table below. The detailed calculations used to arrive at these figures are provided in previous sections of this document.

Combined Commodity	Premium Margin	SPAN Requirement
BHP	$322.50 dr	$149.07 dr
RIO	$14.50 cr	$223.27 dr
CBA	$542.50 dr	$178.79 dr
Total	**$850.50 dr**	**$551.13 dr**

The total requirement for the above portfolio at an account level is:

Margin	Requirement
Premium Margin	$ 850.50 dr
SPAN Requirement	$ 551.13 dr
Total Requirement	**$1,401.63 dr**

NOTE: In the case where the total requirement is a credit i.e. where positive premium margin for the account exceeds the SPAN requirement, the final requirement for the account would be $0.00.

Appendix I – Portfolio and Margin Rate Details

Hypothetical portfolio and margin rate assumptions used in the SPAN calculation example.

Portfolio

	BHP		RIO		CBA	
Contract	Aug 12 Call 31.50 AMER	Oct 12 Call 30.50 AMER	Aug 12 Put 56.00 AMER	Aug 12 Call 58.00 AMER	Aug 12 Call 53.00 AMER	Nov 12 Put 54.00 AMER
Underlying Equity Price	$31.80	$31.80	$57.42	$57.42	$53.32	$53.32
Time to Expiry (in years)	0.084932	0.238356	0.084932	0.084932	0.084932	0.334247
Risk Free Interest Rate	3.58%	3.5617%	3.58%	3.58%	3.58%	3.5467%
Volatility	23.1331%	25.77%	27.5069%	25.481%	12.0535%	15.2749%
Number of Underlying Equities	100	100	100	100	100	100
Number of contracts	-1	-1	1	-1	1	-2

	BHP		RIO		CBA	
Option Market Price	$1.07	$2.155	$1.42	$1.275	$0.815	$3.12
Option Market Value	$107	$215.5	$142	$127.50	$81.5	$312

Margin Rates

Margin Rate	BHP	RIO	CBA
Price Scanning Range	6%	6%	3%
Volatility Scanning Range	2%	2%	2%
Short Option Minimum Charge	$0.50	$0.50	$0.50

Concession Priority	Combined Commodity A	DPSR A	Combined Commodity B	DPSR B	Concession
1	BHP	1	RIO	1	55%
2	BHP	1	CBA	1	47%
3	CBA	1	RIO	1	33%

Appendix II – Risk Arrays

The standard 16 SPAN scenarios

1. Underlying equity price unchanged; Volatility up; time reduced by 2 days
2. Underlying equity price unchanged; Volatility down; time reduced by 2 days
3. Underlying equity price up 1/3 range; Volatility up; time reduced by 2 days
4. Underlying equity price up 1/3 range; Volatility down; time reduced by 2 days
5. Underlying equity price down 1/3 range; Volatility up; time reduced by 2 days
6. Underlying equity price down 1/3 range; Volatility down; time reduced by 2 days
7. Underlying equity price up 2/3 range; Volatility up; time reduced by 2 days
8. Underlying equity price up 2/3 range; Volatility down; time reduced by 2 days
9. Underlying equity price down 2/3 range; Volatility up; time reduced by 2 days
10. Underlying equity price down 2/3 range; Volatility down; time reduced by 2 days
11. Underlying equity price up 3/3 range; Volatility up; time reduced by 2 days
12. Underlying equity price up 3/3 range; Volatility down; time reduced by 2 days
13. Underlying equity price down 3/3 range; Volatility up; time reduced by 2 days
14. Underlying equity price down 3/3 range; Volatility down; time reduced by 2 days
15. Underlying equity price up extreme move (cover 35% of loss) ; time reduced by 2 days
16. Underlying equity price down extreme move (cover 35% of loss) ; time reduced by 2 days

Using the sample portfolio and margin rates in Appendix I, the risk arrays for the combined commodities are provided below for determination of scan risk and the intercommodity spread credit.

Risk Arrays: BHP Combined Commodity

Scenario	BHP Aug 12 Call 31.5 AMER	BHP Oct 12 Call 30.50 AMER	Scenario Total
1	-1.46	0.88	-0.58
2	-4.69	-4.5	-9.19
3	37.87	44.46	82.33
4	35.02	39.09	74.11
5	-34.88	-41.54	-76.42
6	-38.11	-47.36	-85.47

Scenario	BHP Aug 12 Call 31.5 AMER	BHP Oct 12 Call 30.50 AMER	Scenario Total
8	86.8	90.96	177.76
8	84.19	86.45	170.64
9	-62.2	-74.32	-136.52
10	-64.85	-80.15	-145.00
11	139.09	144.14	**283.23 (Active)**
12	137.35	140.52	277.87 (Paired)
13	-79.82	-105.27	-185.09
14	-82.49	-111.1	-193.59
15	110.62	109.53	220.15
16	-36.53	-60.91	-97.44

Risk Arrays: RIO Combined Commodity

Scenario	RIO Aug 12 Put 56.00 AMER	RIO Aug 12 Call 58.00 AMER	Scenario Total
1	1.97	-1.36	0.61
2	8.8	-7.72	1.08
3	46	54.96	100.96
4	52.83	48.61	101.44
5	-50.38	-46.29	-96.67
6	-43.56	-51.73	-95.29
7	75.02	130.44	205.46
8	80.62	124.72	205.34
9	-114.77	-80.68	-195.45
10	-108.01	-85.45	-193.46
11	100.76	212.31	**313.07 (Active)**
12	104.54	208.44	312.98 (Paired)
13	-192.88	-99.75	-292.63
14	-187.32	-103.41	-290.73
15	46.56	181.65	228.21
16	-167.47	-43.78	-211.25

Risk Arrays: CBA Combined Commodity

Scenario	CBA Aug 12 Call 53.00 AMER	CBA Nov 12 Put 54.00 AMER	Scenario Total
1	-2.35	4.35	2
2	-0.09	-7.54	-7.63
3	-37.33	-70.28	-107.61
4	-35.69	-83.41	-119.1
5	27.15	80.95	108.1
6	29.47	69.31	98.78
7	-80.68	-131.29	-211.97
8	-79.06	-145.81	-224.87
9	50.1	159.69	209.79
10	52.43	149.19	201.62
11	-127.42	-189.31	-316.73
12	-126.54	-204.05	-330.59
13	63.57	243.08	**306.65 (Active)**
14	65.36	235.74	301.1 (Paired)
15	-98.47	-121.72	-220.19
16	28.12	182.63	210.75

Appendix III – Composite delta

Composite delta is derived as the weighted average of the deltas, where the weights are associated with each underlying price scan point. In effect, the composite delta is a forward looking estimate of the option delta. The standard SPAN seven delta points are:

Scenario	Underlying price change as % of price scan range	Probability Weight
1	Unchanged	0.270
3	Up 33%	0.217
5	Down 33%	0.217
7	Up 67%	0.110
9	Down 67%	0.110
11	Up 100%	0.037
13	Down 100%	0.037

Using the sample portfolio and margin rates in Appendix I, the delta points for the combined commodities are provided below for determination of the intercommodity spread credit.

Composite delta – BHP combined commodity

Scenario	BHP Aug 12 Call 31.50 AMER	BHP Oct 12 Call 30.50 AMER	BHP
1	0.158411	0.178472	0.336883
3	0.100853	0.128142	0.228996
5	0.152639	0.158698	0.311337
7	0.037725	0.057334	0.095059
9	0.088234	0.087838	0.176072
11	0.008537	0.016213	0.024750
13	0.032125	0.031064	0.063189
Composite Delta			**1.236286**

Composite delta - RIO combined commodity

Scenario	RIO Aug 12 Put 56.00 AMER	RIO Aug 12 Call 58.00 AMER	RIO
1	-0.110621	0.120149	0.009528
3	-0.111699	0.070695	-0.041003
5	-0.067251	0.124440	0.057189
7	-0.069202	0.023692	-0.045510
9	-0.025377	0.076681	0.051304
11	-0.026715	0.005089	-0.021625
13	-0.005760	0.029464	0.023703
Composite Delta			**0.033585**

Composite delta - CBA combined commodity

Scenario	CBA Aug 12 Call 53.00 AMER	CBA Nov 12 Put 54.00 AMER	CBA
1	0.166915	-0.187351	-0.020436
3	0.103190	-0.160826	-0.057636
5	0.162982	-0.140531	0.022451

Scenario	CBA Aug 12 Call 53.00 AMER	CBA Nov 12 Put 54.00 AMER	CBA
7	0.036321	-0.087801	-0.051480
9	0.094253	-0.065808	0.028445
11	0.007711	-0.030963	-0.023253
13	0.033936	-0.020011	0.013925
Composite Delta			**-0.087983**

Appendix IV – Net Delta

In determining the intracommodity spread charge, intercommodity spread credit and delivery risk for a combined commodity, SPAN requires spreads to be formed/spot positions to be based on equivalent units in the underlying. Combined commodities may consist of many product types (e.g. equities, option on equities and equity low exercise price options) and as such requires units in these products to be converted into equivalent units of the underlying for SPAN to process its calculations indicated above at the combined commodity level.

In the case of the equity option portfolio in Appendix I, the number of equity option contracts is converted into equivalent units of the underlying equity. This is done by multiplying the number of option contracts by the corresponding delta for that option. An example of the net delta calculation for the portfolio outlined in Appendix I is provided below. The net delta for this equity option portfolio is used particularly for the intercommodity spread credit, as the intracommodity spread charge and delivery risk are not applicable for this portfolio. As the underlying equity does not have an expiration date, the net delta is aggregated into a special period zero.

Combined Commodity	Number of Contracts	SPAN's Composite Delta*	Net Delta
BHP			
BHP Aug 12 $31.50 Call	-1	0.57852	-0.57852
BHP Oct 12 $30.50 Call	-1	0.65776	-0.65776
Net Delta			**-1.23630**
RIO			
RIO Aug 12 $56.00 Put	1	-0.41663	-0.41663
RIO Aug 12 $58.00 Call	-1	0.45021	-0.45021
Net Delta			**-0.8668**
CBA			
CBA Aug 12 $53.00 Call	1	0.60531	0.60531
CBA Nov 12 $54.00 Put	-2	-0.69329	
Net Delta			**1.9919**

*Further detail on SPAN's composite delta is provided in Appendix III.

Appendix V - Weighted Futures Price Risk (WFPR)

The Weighted Future Price Risk (WFPR) is used in the determination of the intercommodity spread credit. The WFPR risk for each combined commodity is based on the price risk and net delta for the combined commodity.

PRICE RISK

In order to determine the WFPR, the price risk first needs to be extracted from the scan risk estimate. The scan risk, particularly for options, factors in movements in both the underlying price (price risk) and volatility (volatility risk) and a reduction in the time to maturity of the option (time risk). The extraction of price risk is to ensure consistency with the concession rate that is based on movements in the underlying price.

Scan risk

The scan risk is derived from the risk arrays and is the worst case scenario for a combined commodity. This associated scenario is called the active scenario.

Scan Risk = Risk Array Value of active scenario ≈ Price risk + Volatility Risk + Time Risk

Volatility Risk

The volatility risk is estimated from the risk arrays by using the combination of scenarios where price movement is the same but the opposite definition of volatility movement.

$$\text{Volatility Risk} = \frac{\text{Risk Array Value of active scenario - Risk Array Value of paired point}}{2}$$

Time Risk

The time risk is estimated from the risk arrays by using the combination of scenarios where there are no price movements and opposite volatility changes (Scenario 1 and Scenario 2).

$$\text{Time Risk} = \frac{\text{Risk Array Value of scenario 1+Risk Array Value of scenario 2}}{2}$$

Price Risk

The price risk is estimated using estimates of scan risk, volatility and time risk.

Price Risk = Scan risk - Volatility Risk - Time Risk

WEIGHTED FUTURES PRICE RISK

The price risk and net delta can then be used to determine the WFPR for the combined commodity as follows

$$\text{Weighted Futures Price Risk} = \frac{\text{Price Risk}}{|\text{Net Delta}|}$$

The net delta is explained in Appendix IV.

Using the portfolio in Appendix I, the WFPR calculation is outlined below. The risk array values in the table are provided in Appendix II.

	BHP	RIO	CBA
Scan Risk	$283.23	$313.07	$306.65
Risk Array Value (Active Scenario)	$283.23	$313.07	$306.65
Volatility Risk	$2.68	$0.05	$2.78
Risk Array Value (Active Scenario)	$283.23	$313.07	$306.65
Risk Array Value (Paired Point)	$277.87	$312.98	$301.10
Time Risk	$-4.89	$0.85	$-2.82
Risk Array Value (Scenario 1)	$-0.58	$0.61	$2.00
Risk Array Value (Scenario 2)	$-9.19	$1.08	$-7.63
Price Risk	$285.44	$312.17	$306.69
Scan Risk	$283.23	$313.07	$306.65
Volatility Risk	$2.68	$0.05	$2.78

	BHP	RIO	CBA
Time Risk	$-4.89	$0.85	$-2.82
Weighted Futures Price Risk (WFPR)	**$230.88**	**$360.14**	**$153.96**
Price Risk	$285.44	$312.17	$306.69
Net Delta	$-1.23630	$-0.8668	$1.9919

*Paired point - Risk Array value with the same definition for price movement as the active scenario, but the opposite definition of volatility movement.

More Information

To assist Clearing Participants and clients with information on SPAN, a PC-based SPAN calculator developed by the Chicago Mercantile Exchange (CME) known as PC-SPAN is available from CME.

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