AFFIX

{{wiktionarypar}}
An **affix** is a morpheme that is attached to a word stem to form a new word. Affixes may be derivational, like English *-ness* and *pre-*, or inflectional, like English plural *-s* and past tense *-ed*. They are bound morphemes by definition; prefixes and suffixes may be separable affixes. Affixation is, thus, the linguistic process speakers use to form new words (neologisms) by adding sounds (affixes) at the beginning (prefixation), the middle (infixation) or the end (suffixation) of words.
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POSITIONAL CATEGORIES OF AFFIXES

Affixes are divided into several categories, depending on their position with reference to the stem. *Prefix* and *suffix* are extremely common terms. *Infix* and *circumfix* are less so, as they are not important in European languages. The other terms are uncommon.
Categories of affixesAffix Example Schema Description**Prefix** un-do prefix-stem Appears at the front of a stem**Suffix/Postfix** look-ing stem-suffix Appears at the back of a stem**Infix** saxo‹ma›phone st‹infix›em Appears within a stem — common in Borneo-Philippines languages**Circumfix** a›scatter‹ed circumfix›stem‹circumfix One portion appears at the front of a stem, and the other at the rear**Interfix** speed-o-meter $stem_a$-interfix-$stem_b$ Links two stems together in a compound**Duplifix** teeny~weeny stem~duplifix Incorporates a reduplicated portion of a stem (may occur in front, at the rear, or within the stem)**Transfix** Maltese: k‹i›t‹e›b "he wrote" (compare root *ktb* "write") s‹transfix›te‹transfix›m A discontinuous affix that interleaves within a discontinuous stem**Simulfix** mouse mice Changes a segment of a stem**Suprafix** **pro**duce (noun) pro**duce** (verb) Changes a suprasegmental phoneme of a stem**Disfix** Alabama: tipli "break up" (compare root *tipasli* "break") stm The elision of a portion of a stem
Prefix and *suffix* may be subsumed under the term *adfix* in contrast to *infix*.
In transcription, for example in the third column in the chart above, simple affixes such as prefixes and suffixes are shown connected to the stem with hyphens. Affixes which disrupt the stem, or which themselves are discontinuous, are often marked off with angle brackets. Reduplication is often shown with a tilde.
LEXICAL AFFIXES

Lexical affixes (or *semantic affixes*) are bound elements that appear as affixes, but function as incorporated nouns within verbs and as elements of compound nouns. In other words, they are similar to word roots/stems in function but similar to affixes in form. Although similar to incorporated nouns, lexical affixes differ in that they never occur as freestanding nouns, i.e. they always appear as affixes.
Lexical affixes are relatively rare. The Wakashan, Salishan, and Chimakuan languages all have lexical suffixes — the presence of these is an areal feature of the Pacific Northwest of the North America.
The lexical suffixes of these languages often show little to no resemblance to free nouns with similar meanings. Compare the lexical suffixes and free nouns of Northern Straits Saanich written in the Saanich orthography and in Americanist notation:
Lexical SuffixNoun-o,-a"person",etálewtelx"person"-nát-net"day"sielskil"day"-sen-sn"foot, lower leg"sxene,sxn"foot, lower leg"-áwtw-ewtx"building, house, campsite",á,leel"house"

Lexical suffixes when compared with free nouns often have a more generic or general meaning. For instance, one of these languages may have a lexical suffix that means water in a general sense, but it may not have any noun equivalent referring to water in general and instead have several nouns with a more specific meaning (such "saltwater", "whitewater", etc.). In other cases, the lexical suffixes have become grammaticalized to various degrees.

Some linguists have claimed that these lexical suffixes provide only adverbial or adjectival notions to verbs. Other linguists disagree arguing that they may additionally be syntactic arguments just as free nouns are and thus equating lexical suffixes with incorporated nouns. Gerdts (2003) gives examples of lexical suffixes in the Halkomelem language (the word order here is Verb Subject Object):

|- style="line-height: 1.0em; font-size: 75%" | | | style="background: #bbbbff" | VERB | style="background: #ffebad" | SUBJ | style="background: #ffbbbb" | OBJ |- | (1) | ni | šak'-t-s | seni | qeq|- | | colspan="3" | "the woman washed the baby" |- style="line-height: 1.0em; font-size: 75%" | bgcolor=white colspan=5| |- style="line-height: 1.0em; font-size: 75%" | | | style="background: #bbbbff" | VERB+LEX.SUFF| style="background: #ffebad" | SUBJ | |- | (2) | ni | šk'-y| seni | |- | | colspan="3" | "the woman baby-washed" |}

In sentence (1), the verb "wash" is {{unicode}} where {{unicode}} is the root and {{unicode}} and {{unicode}} are inflectional suffixes. The subject "the woman" is {{unicode}} and the object "the baby" is {{unicode}}. In this sentence, "the baby" is a free noun. (The {{unicode}} here is an auxiliary, which can be ignored for explanatory purposes.)

In sentence (2), "baby" does not appear as a free noun. Instead it appears as the lexical suffix {{unicode}} which is affixed to the verb root {{unicode}} (which has changed slightly in pronunciation, but this can also be ignored here). Note how the lexical suffix is neither "the baby" (definite) nor "a baby" (indefinite); such referential changes are routine with incorporated nouns.

ORTHOGRAPHIC AFFIXES

In orthography, the terms for affixes may be used for the smaller elements of conjunct characters. For example, Maya glyphs are generally compounds of a *main sign* and smaller *affixes* joined at its margins. These are called *prefixes, superfixes, postfixes,* and *subfixes* according to their position to the left, on top, to the right, or at the bottom of the main glyph. A small glyph placed inside another is called an *infix*.[1] Similar terminology is found with the conjunct consonants of the Indic alphabets. For example, the Tibetan alphabet utilizes prefix, suffix, superfix, and subfix consonant letters.[2]

SEE ALSO

{{wiktionarypar}}
- Agglutination
- Augmentative
- Binary prefix
- Clitic
- Concatenation
- Derivation
- Diminutive
- English prefixes
- Family name affixes
- Internet-related prefixes
- Marker (linguistics)
- Separable affix
- SI prefix
- Stemming - affix removal using computer software
- Unpaired word
- Word formation

REFERENCES

{{reflist}}

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119); Mercury series. Hull, Quebec: Canadian Museum of Civilization. ISBN 0660129086

EXTERNAL LINKS

- Comprehensive and searchable affix dictionary reference

af:Affiksar:br:Kengercv:cs:Afixcy:Dodiadde:Affixes:Afijoeo:Afiksofr:Affixefy:Affiksgl:Afixoid:Afiksia:Affixoio:Afixois:Aðskeytiit:Affissohe:ku:Gîrek (zimannasî)la:Affixumlt:Afiksasjbo:rafsihu:Toldalékmt:Affissnl:Affixja:no:Affiksnn:Affiksnds:Affixpl:Zrostekpt:Afixoro:Afixru:fi:Affiksisv:Affixth:vi:Phtuk:wa:Sititchete (linwince)yi:zh:

B-52 (DISAMBIGUATION)

B-52 may refer to:

- Bundesstraße 52, a German road
- B-52 Stratofortress, a strategic bomber aircraft designed by Boeing
- B-52 hairstyle, a type of beehive, named after the aircraft
- The B-52's, a rock band, named after the hairstyle named after the aircraft
- B-52, a cocktail shooter named after the aircraft
- Nora B-52, a Serbian 152 mm self-propelled howitzer

B52 may refer to:

- B52 (New York City bus) in Brooklyn
- One of the Encyclopaedia of Chess Openings codes for the Sicilian Defence in chess
- HLA-B52, is an HLA-B serotype
- Medical slang in psychiatric wards, 5 mg of haldol and 2 mg of ativan. Some places its 50 mg of benadryl instead of the haldol and sometimes 1 mg cogentin is added with the haldol to counteract the extrapyramidal side effects of the haldol. Usually given to severly agitated patients and given I.M.

{{disambig}}

de:B 52fr:B-52 (homonymie)it:B52nl:B-52ja:B-52ru:-52vi:B-52 (nhhng)

BRÃ-SINGAMEN

Heimdall returns Brisingamen to Freyja

{{Cleanup}} In Norse mythology, ***Brísingamen*** (from Old Norse *brisinga* "flaming, glowing" and *men* "jewellry, ornament")[1] is the necklace of the goddess Freyja (or Frigg in some mythological writings).[2]

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- Poetic Edda
- Prose Edda
- Sörla þáttr
- Archaeological record
- Modern influence
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ATTESTATIONS

BEOWULF

Brísingamen is referred to in the Anglo-Saxon epic *Beowulf* as *Brosinga mene*. The brief mention in *Beowulf* is as follows (trans. by Howell Chickering, 1977):

...since Hama bore off
to the shining city the
Brosings' necklace,
Gem-figured filigree. He
gained the hatred
Of Eormanric the Goth, chose
eternal reward.

This seems to confuse two different stories as the *Beowulf* poet is clearly referring to the *Dietrich Cycle*. The *Þiðrekssaga* tells that the warrior Heime (*Hama* in Old English) takes sides against Eormanric, king of the Goths, and has to flee his kingdom after robbing him; later in life, Hama enters a monastery and gives them all his stolen treasure. However, this saga makes no mention of the great necklace. Possibly the *Beowulf* poet was confused, or invented the addition of the necklace to give him an excuse to drag in a mention of Eormanric. In any case, the necklace given to Beowulf in the story is not the Brísingamen itself; it's only

being compared to it.

POETIC EDDA

In the poem *Þrymskviða* of the *Poetic Edda*, Thrymr, the King of the Jötuns, steals Thor's Mjolnir. Freyja lends Loki her falcon cloak to search for it; but upon returning, Loki tells Freyja that Thrymr has hidden the hammer and demanded to marry her in return. Freyja is so wrathful that all the Æsir's halls beneath her are shaken and the necklace Brísingamen breaks off from her neck. Later Thor borrows Brísingamen when he dresses up as Freyja to go to the wedding at Jötunheim.

This myth is also recorded in a Swedish folksong called the *Thor song* (18th Century), where Freyja is called Miss Frojenborg, "den väna solen" (the fair sun).[3]

PROSE EDDA

Húsdrápa, a skaldic poem partially preserved in the *Prose Edda*, relates the story of the theft of Brísingamen by Loki. One day when Freyja wakes up and finds Brísingamen missing, she enlists the help of Heimdall to help her search for it. Eventually they find the thief, who turns out to be Loki who has transformed himself into a seal. Heimdall turns into a seal as well and fights Loki. After a lengthy battle at Singasteinn, Heimdall wins and returns Brísingamen to Freyja.

Snorri Sturluson quoted this old poem in *Skáldskaparmál*, saying that because of this legend Heimdall is called "Seeker of Freyja's Necklace" (*Skáldskaparmál*, section 8) and Loki is called "Thief of Brísingamen" (*Skáldskaparmál*, section 16). A similar story appears in the later *Sörla þáttr*, where Heimdall does not appear.

SÖRLA ÞÁTTR

Sörla þáttr is a short story in the later and extended version of the *Saga of Olaf Tryggvason*[4] in the manuscript of the *Flateyjarbók*, which was written and compiled by two Christian priests, Jon Thordson and Magnus Thorhalson, in late 14th century.[5] In the end of the story, the arrival of Christianity dissolves the old curse that traditionally was to endure until Ragnarök.

"Freyja was a human in Asia and was the favorite concubine of Odin, King of Asialand. When this woman wanted to buy a golden necklace (no name given) forged by four dwarves (named Dvalinn, Alfrik, Berling, and Grer), she offered them gold and silver but they replied that they would only sell it to her if she would lie a night by each of them. She came home afterward with the necklace and kept silent as if nothing happened. But a man called Loki somehow knew it, and came to tell Odin. King Odin commanded Loki to steal the necklace, so Loki turned into a fly to sneak into Freyja's bower and stole it. When Freyja found her necklace missing, she came to ask king Odin. In exchange for it, Odin ordered her to make two kings, each served by twenty kings, fight forever unless some christened men so brave would dare to enter the battle and slay them. She said yes, and got that necklace back. Under the spell, king Högni and king Heðinn battled for one hundred and forty-three years, as soon as they fell down they had to stand up again and fight on. But in the end, the Christian lord Olaf Tryggvason, who has a great fate and luck, arrived with his christened men, and whoever slain by a Christian would stay dead. Thus the pagan curse was finally dissolved by the arrival of Christianity. After that, the noble man, king Olaf, went back to his realm."[6]

The battle of Högni and Heðinn is recorded in several medieval sources, including the skaldic poem *Ragnarsdrápa*, *Skáldskaparmál* (section 49),

and *Gesta Danorum*: king Högni's daughter, Hildr, is kidnapped by king Heðinn. When Högni comes to fight Heðinn on an island, Hildr comes to offer her father a necklace on behalf of Heðinn for peace; but the two kings still battle, and Hildr resurrects the fallen to make them fight until Ragnarök.[7] None of these earlier sources mentions Freyja or king Olaf Tryggvason, the historical figure who christianized Norway and Iceland in the 10th Century.

ARCHAEOLOGICAL RECORD

The pendant, in the Swedish Museum of National Antiquities in Stockholm.

C. 1000, a pagan priestess (Völva) was buried with considerable splendour in Hagebyhöga in Östergötland. In addition to being buried with her wand, she had received great riches which included horses, a wagon and an Arabian bronze pitcher. There was also a silver pendant which represents a woman with a broad necklace around her neck. This kind of necklace was only worn by the most prominent women during the Iron Age and some have interpreted it as Freyja's favourite necklace Brísingamen. The pendant may represent Freyja herself.[8]

MODERN INFLUENCE

Alan Garner wrote a children's fantasy novel called *The Weirdstone of Brisingamen* about an enchanted teardrop bracelet.

REFERENCES

{{Reflist}}

{{Norse mythology}}

da:Brisingernes

smykkede:Brisingamenes:Brisingamenfr:Collier des Brísingarko:

hr:Brisingamenit:Brísingamenlv:Brisingamenalt:Brisingamenasja:

no:Brisingamennn:Brisingamenpl:Brisingamenpt:Brisingamenru:sv:Brisingasmycketzh:

ANGLE

{{otheruses4}}

"", the angle symbol.

In geometry and trigonometry, an **angle** (in full, **plane angle**) is the figure formed by two rays sharing a common endpoint, called the vertex of the angle {{harv}}. The magnitude of the angle is the "amount of rotation" that separates the two rays, and can be measured by considering the length of circular arc swept out when one ray is rotated about the vertex to coincide with the other (see "Measuring angles", below). Where there is no possibility of confusion, the term "angle" is used interchangeably for both the geometric configuration itself and for its angular magnitude (which is simply a numerical quantity).

The word *angle* comes from the Latin word *angulus*, meaning "a corner". The word *angulus* is a diminutive, of which the primitive form, *angus*, does not occur in Latin. Cognate words are the Latin *angere*, meaning "to compress into a bend" or "to strangle", the Greek {{polytonic}} *(ankyls)*, meaning "crooked, curved," and the English word "ankle." All three are connected with the Proto-Indo-European root **ank-*, meaning "to bend" or "bow" {{harv}}.

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HISTORY

Euclid defines a plane angle as the inclination to each other, in a plane, of two lines which meet each other, and do not lie straight with respect to each other. According to Proclus an angle must be either a quality or a quantity, or a relationship. The first concept was used by Eudemus, who regarded an angle as a deviation from a straight line; the second by Carpus of Antioch, who regarded it as the interval or space between the intersecting lines; Euclid adopted the third concept, although his definitions of right, acute, and obtuse angles are certainly quantitative.

MEASURING ANGLES

The angle is the quotient of s and r.

In order to measure an angle , a circular arc centered at the vertex of the angle is drawn, e.g. with a pair of compasses. The length of the arc s is then divided by the radius of the circle r, and possibly multiplied by a scaling constant k (which depends on the units of measurement that are chosen): \theta = \frac{s}{r}(k).

The value of thus defined is independent of the size of the circle: if the length of the radius is changed then the arc length changes in the same proportion, so the ratio *s*/*r* is unaltered.

In many geometrical situations, angles that differ by an exact multiple of a full circle are effectively equivalent (it makes no difference how many times a line is rotated through a full circle because it always ends up in the same place). However, this is not always the case. For example, when tracing a curve such as a spiral using polar coordinates, an extra full turn gives rise to a quite different point on the curve.

UNITS

Angles are considered dimensionless, since they are defined as the ratio of lengths. There are, however, several units used to measure angles, depending on the choice of the constant k in the formula above. Of these units, treated in more detail below, the *degree* and the *radian* are by far the most common.

With the notable exception of the radian, most units of angular measurement are defined such that one full circle (i.e. one revolution) is equal to *n* units, for some whole number *n*. For example, in the case of degrees, {{nowrap}} A full circle of *n* units is obtained by setting {{nowrap}} in the formula above. (Proof. The formula above can be rewritten as {{nowrap}} One full circle, for which {{nowrap}} units, corresponds to an arc equal in length to the circle's circumference, which is 2*r*, so {{nowrap}}. Substituting *n* for and 2*r* for *s* in the formula, results in {{nowrap}})

- The **degree**, denoted by a small superscript circle (°) is 1/360 of a full circle, so one full circle is 360°. One advantage of this old sexagesimal subunit is that many angles common in simple geometry are measured as a whole number of degrees. Fractions of a degree may be written in normal decimal notation (e.g. 3.5° for three and a half degrees), but the following sexagesimal subunits of the "degree–minute–second" system are also in use, especially for geographical coordinates and in astronomy and ballistics:
- The **minute of arc** (or **MOA**, **arcminute**, or just **minute**) is 1/60 of a degree. It is denoted by a single prime ( ). For example, 3° 30 is equal to 3 + 30/60 degrees, or 3.5 degrees. A mixed format with decimal fractions is also sometimes used, e.g. 3° 5.72 = 3 + 5.72/60 degrees. A nautical mile was historically defined as a minute of arc along a great circle of the Earth.
- The **second of arc** (or **arcsecond**, or just **second**) is 1/60 of a minute of arc and 1/3600 of a degree. It is denoted by a double prime ( ). For example, 3° 7 30 is equal to 3 + 7/60 + 30/3600 degrees,

or 3.125 degrees.
= s/r rad = 1 rad.

- The **radian** is the angle subtended by an arc of a circle that has the same length as the circle's radius (k = 1 in the formula given earlier). One full circle is 2 radians, and one radian is 180/ degrees, or about 57.2958 degrees. The radian is abbreviated *rad*, though this symbol is often omitted in mathematical texts, where radians are assumed unless specified otherwise. The radian is used in virtually all mathematical work beyond simple practical geometry, due, for example, to the pleasing and "natural" properties that the trigonometric functions display when their arguments are in radians. The radian is the (derived) unit of angular measurement in the SI system.
- The **mil** is *approximately* equal to a milliradian. There are several definitions.
- The **full circle** (or **revolution**, **rotation**, **full turn** or **cycle**) is one complete revolution. The revolution and rotation are abbreviated *rev* and *rot*, respectively, but just *r* in *rpm* (revolutions per minute). 1 full circle = 360° = 2 rad = 400 gon = 4 right angles.
- The **right angle** is 1/4 of a full circle. It is the unit used in Euclid's Elements. 1 right angle = 90° = /2 rad = 100 gon.
- The **angle of the equilateral triangle** is 1/6 of a full circle. It was the unit used by the Babylonians, and is especially easy to construct with ruler and compasses. The degree, minute of arc and second of arc are sexagesimal subunits of the Babylonian unit. 1 Babylonian unit = 60° = /3 rad 1.047197551 rad.
- The **grad**, also called **grade**, **gradian**, or **gon** is 1/400 of a full circle, so one full circle is 400 grads and a right angle is 100 grads. It is a decimal subunit of the right angle. A kilometer was historically defined as a centi-gon of arc along a great circle of the Earth, so the kilometer is the decimal analog to the sexagesimal nautical mile. The gon is used mostly in triangulation.
- The **point**, used in navigation, is 1/32 of a full circle. It is a binary subunit of the full circle. Naming all 32 points on a compass rose is called "boxing the compass". 1 point = 1/8 of a right angle = 11.25° = 12.5 gon.
- The astronomical **hour angle** is 1/24 of a full circle. Since this system is amenable to measuring objects that cycle once per day (such as the relative position of stars), the sexagesimal subunits are called **minute of time** and **second of time**. Note that these are distinct from, and 15 times larger than, minutes and seconds of arc. 1 hour = 15° = /12 rad = 1/6 right angle 16.667 gon.
- The **binary degree**, also known as the **binary radian** (or **brad**), is 1/256 of a full circle. The binary degree is used in computing so that an angle can be efficiently represented in a single byte (albeit to limited precision unless the angle happens to be an exact multiple of 1/256 of a circle).
- The **grade of a slope**, or **gradient**, is not truly an angle measure (unless it is explicitly given in degrees, as is occasionally the case). Instead it is equal to the tangent of the angle, or sometimes the sine. Gradients are often expressed as a percentage. For the usual small values encountered (less than 5%), the grade of a slope is approximately the measure of an angle in radians.

POSITIVE AND NEGATIVE ANGLES

A convention universally adopted in mathematical writing is that angles given a sign are **positive angles** if measured anticlockwise, and **negative angles** if measured clockwise, from a given line. If no line is specified, it can be assumed to be the x-axis in the Cartesian plane. In many geometrical situations a negative angle of is effectively equivalent to a positive angle of "one full rotation less ". For example, a clockwise rotation of 45° (that is, an angle of 45°) is often effectively equivalent to an anticlockwise rotation of

360° 45° (that is, an angle of 315°).
In three dimensional geometry, "clockwise" and "anticlockwise" have no absolute meaning, so the direction of positive and negative angles must be defined relative to some reference, which is typically a vector passing through the angle's vertex and perpendicular to the plane in which the rays of the angle lie.
In navigation, bearings are measured from north, increasing clockwise, so a bearing of 45 degrees is north-east. Negative bearings are not used in navigation, so north-west is 315 degrees.

APPROXIMATIONS

- 1° is approximately the width of a little finger at arm's length.
- 10° is approximately the width of a closed fist at arm's length.
- 20° is approximately the width of a handspan at arm's length.

These measurements clearly depend on the individual subject, and the above should be treated as rough approximations only.

IDENTIFYING ANGLES

In mathematical expressions, it is common to use Greek letters (, , , , , ...) to serve as variables standing for the size of some angle. (To avoid confusion with its other meaning, the symbol is typically not used for this purpose.) Lower case roman letters (a, b, c, ...) are also used. See the figures in this article for examples.
In geometric figures, angles may also be identified by the labels attached to the three points that define them. For example, the angle at vertex A enclosed by the rays AB and AC (i.e. the lines from point A to point B and point A to point C) is denoted BAC or BÂC. Sometimes, where there is no risk of confusion, the angle may be referred to simply by its vertex ("angle A").
Potentially, an angle denoted, say, BAC might refer to any of four angles: the clockwise angle from B to C, the anticlockwise angle from B to C, the clockwise angle from C to B, or the anticlockwise angle from C to B, where the direction in which the angle is measured determines its sign (see Positive and negative angles). However, in many geometrical situations it is obvious from context that the positive angle less than or equal to 180° degrees is meant, and no ambiguity arises. Otherwise, a convention may be adopted so that BAC always refers to the anticlockwise (positive) angle from B to C, and CAB to the anticlockwise (positive) angle from C to B.

TYPES OF ANGLES

Right angle.
Reflex angle.
The complementary angles a and b (b is the complement of a, and a is the complement of b).

Acute (a), obtuse (b), and straight (c) angles. Here, a and b are supplementary angles.

- An angle of 90° (/2 radians, or one-quarter of the full circle) is called a **right angle**. Two lines that form a right angle are said to be **perpendicular** or **orthogonal**.
- Angles smaller than a right angle (less than 90°) are called **acute angles** ("acute" meaning "sharp").
- Angles larger than a right angle and smaller than two right angles (between 90° and 180°) are called **obtuse angles** ("obtuse" meaning "blunt").
- Angles equal to two right angles (180°) are called **straight angles**.
- Angles larger than two right angles but less than a full circle (between 180° and 360°) are called **reflex angles**.
- Angles that have the same measure (i.e. the same magnitude) are sometimes said to be **congruent**, though the diagrams that represent them need not be congruent, so others *(including Euclid)* prefer to say that they are equal in size, or just "equal".
- Two angles opposite each other, formed by two intersecting straight lines that form an "X"-like shape, are called **vertical angles** or **opposite angles**. These angles are equal in size.
- Angles that share a common vertex and edge but do not share any interior points are called **adjacent angles**.

- Two angles that sum to one right angle (90°) are called **complementary angles**. The difference between an angle and a right angle is termed the **complement** of the angle.
- Two angles that sum to a straight angle (180°) are called **supplementary angles**. The difference between an angle and a straight angle is termed the **supplement** of the angle.
- Two angles that sum to one full circle (360°) are called **explementary angles** or **conjugate angles**.
- An angle that is part of a simple polygon is called an **interior angle** if it lies on the inside of that simple polygon. A concave simple polygon has at least one interior angle that exceeds 180°. In Euclidean geometry, the measures of the interior angles of a triangle add up to radians, or 180°; the measures of the interior angles of a simple quadrilateral add up to 2 radians, or 360°. In general, the measures of the interior angles of a simple polygon with *n* sides add up to [(*n* 2) ×] radians, or [(*n* 2) × 180]°.
- The angle supplementary to the interior angle is called the **exterior angle**. It measures the amount of "turn" one has to make at this vertex to trace out the polygon. If the corresponding interior angle exceeds 180°, the exterior angle should be considered negative. Even in a non-simple polygon it may be possible to define the exterior angle, but one will have to pick an orientation of the plane (or surface) to decide the sign of the exterior angle measure. In Euclidean geometry, the sum of the exterior angles of a simple polygon will be 360°, one full turn.
- Some authors use the name **exterior angle** of a simple polygon to simply mean the explementary (*not* supplementary!) of the interior angle.[1] This conflicts with the above usage.
- The angle between two planes (such as two adjacent faces of a polyhedron) is called a **dihedral angle**. It may be defined as the acute angle between two lines normal to the planes.
- The angle between a plane and an intersecting straight line is equal to ninety degrees minus the angle between the intersecting line and the line that goes through the point of intersection and is normal to the plane.
- If a straight transversal line intersects two parallel lines, corresponding (alternate) angles at the two points of intersection are equal in size; adjacent angles are supplementary (that is, their measures add to radians, or 180°).

A FORMAL DEFINITION

USING TRIGONOMETRIC FUNCTIONS

A Euclidean angle is completely determined by the corresponding right triangle. In particular, if \theta is a Euclidean angle, it is true that \cos \theta = \frac{x}{\sqrt{x^2 + y^2}} and \sin \theta = \frac{y}{\sqrt{x^2 + y^2}} for two numbers *x* and *y*. So an angle in the Euclidean plane can be legitimately given by two numbers *x* and *y*.
To the ratio *y*/*x* there correspond two angles in the geometric range 0 < <2, since \frac{\sin \theta}{\cos \theta } = \frac{y/\sqrt{x^2 + y^2}}{x/\sqrt{x^2 + y^2}} = \frac{y}{x} = \frac{-y}{-x} = \frac{\sin (\theta + \pi)}{\cos (\theta + \pi) }.

USING ROTATIONS

Suppose we have two unit vectors \vec{u} and \vec{v} in the euclidean plane \mathbb{R}^2. Then there exists one positive isometry (a rotation), and one only, from \mathbb{R}^2 to \mathbb{R}^2 that maps u onto v. Let *r* be such a rotation. Then the relation \vec{a}\mathcal{R}\vec{b} defined by \vec{b}=r(\vec{a}) is an equivalence relation and we call **angle of the rotation *r*** the equivalence class \mathbb{T}/\mathcal{R}, where \mathbb{T} denotes the unit circle of \mathbb{R}^2. The angle between two vectors will simply be the angle of the rotation that maps one onto the

other. We have no numerical way of determining an angle yet. To do this, we choose the vector (1,0), then for any point M on \mathbb{T} at distance \theta from (1,0) (on the circle), let \vec{u}=\overrightarrow{OM}. If we call r_\theta the rotation that transforms (1,0) into \vec{u}, then \left[r_\theta\right]\mapsto\theta is a bijection, which means we can identify any angle with a number between 0 and 2\pi\,.

ANGLES BETWEEN CURVES

The angle between the two curves is defined as the angle between the tangents A and B at P

The angle between a line and a curve (mixed angle) or between two intersecting curves (curvilinear angle) is defined to be the angle between the tangents at the point of intersection. Various names (now rarely, if ever, used) have been given to particular cases:—*amphicyrtic* (Gr. *{{Unicode}}*, on both sides, , convex) or *cissoidal* (Gr. , ivy), biconvex; *xystroidal* or *sistroidal* (Gr. , a tool for scraping), concavo-convex; *amphicoelic* (Gr. , a hollow) or *angulus lunularis*, biconcave.

THE DOT PRODUCT AND GENERALISATION

In the Euclidean plane, the angle between two vectors **u** and **v** is related to their dot product and their lengths by the formula \mathbf{u} \cdot \mathbf{v} = \cos(\theta)\ \|\mathbf{u}\|\ \|\mathbf{v}\|.

This allows one to define angles in any real inner product space, replacing the Euclidean dot product · by the Hilbert space inner product \langle\cdot,\cdot\rangle.

ANGLES IN RIEMANNIAN GEOMETRY

In Riemannian geometry, the metric tensor is used to define the angle between two tangents. Where U and V are tangent vectors and g_{ij} are the components of the metric tensor G,

\cos \theta = \frac{g_{ij}U^iV^j} {\sqrt{ \left| g_{ij}U^iU^j \right| \left| g_{ij}V^iV^j \right|}}.

ANGLES IN GEOGRAPHY AND ASTRONOMY

In geography, the location of any point on the Earth can be identified using a **geographic coordinate system**. This system specifies the latitude and longitude of any location in terms of angles subtended at the centre of the Earth, using the equator and (usually) the Greenwich meridian as references.

In astronomy, a given point on the celestial sphere (that is, the apparent position of an astronomical object) can be identified using any of several **astronomical coordinate systems**, where the references vary according to the particular system. Astronomers measure the **angular separation** of two stars by imagining two lines through the centre of the Earth, each intersecting one of the stars. The angle between those lines can be measured, and is the angular separation between the two stars. Astronomers also measure the **apparent size** of objects as an angular diameter. For example, the full moon has an angular diameter of approximately 0.5°, when viewed from Earth. One could say, "The Moon subtends an angle of half a degree." The small-angle formula can be used to convert such an angular measurement into a distance/size ratio.

SEE ALSO

- Complementary angles
- Supplementary angles
- Central angle
- Inscribed angle
- Solid angle for a concept of angle in three dimensions.
- Astrological aspect
- Protractor
- Clock angle problem
- Great circle distance

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1. Exterior Angle, MathWorld

EXTERNAL LINKS

{{CommonsCat}}

- Angle Bisectors in a Quadrilateral at cut-the-knot
- Constructing a triangle from its angle bisectors at cut-the-knot

•Convert angles in sexagesimal degree format to decimal degrees, and vice-versa
•Angle Estimation –for basic astronomy.
•Angle definition pages with interactive applets.
•Various angle constructions with compass and straightedge Animated demonstrations
{{Link FA}}

af:Hoek (meetkunde)als:Winkel (Geometrie)ar: ()ast:Ángulugn:Takambyay:K'uchuaz:Bucaqbn:be-x-old:bs:Ugaobg:ca:Anglecs:Úhelda:Vinkelde:Winkelet:Nurkel:es:Ánguloeo:Angulofa:fr:Anglegd:Ceàrn (Matamataig)gl:Ángulozh-classical:ko: hr:Kutio:Anguloid:Sudut (geometri)it:Angolohe:sw:Pembe (jiometria)ht:Anglv:Leislt:Kampashu:Szögmk:mr:ms:Sudutnl: Hoek (meetkunde)ja: no:Vinkelkm:pl:Ktpt:Ânguloro: Unghiqu:Chhukaru:simple:Anglesk:Uholsl:Kotsr:su:Juru (élmu ukur)fi:Kulmasv:Vinkelta:th:vi: Góctr:Açuk:zh:

AEACUS

{{for}} {{redirect}}
Aeacus and Telamon by Jean-Michel Moreau le Jeune.
Aeacus (also spelled **Eäcus**, Greek *{{polytonic}}*, "bewailing" or "earth borne"{{fact}}) was a mythological king of the island of Aegina in the Saronic Gulf. He was son of Zeus and Aegina, a daughter of the river-god Asopus.[1] He was born in the island of Oenone or Oenopia, to which Aegina had been carried by Zeus to secure her from the anger of her parents, and whence this island was afterwards called Aegina.[2][3][4][5][6]
According to some accounts Aeacus was a son of Zeus and Europa. Some traditions related that at the time when Aeacus was born, Aegina was not yet inhabited, and that Zeus changed the ants ({{polytonic}}) of the island into men (Myrmidons) over whom Aeacus ruled, or that he made men grow up out of the earth.[7][2][8] Ovid, on the other hand, supposes that the island was not unin-habited at the time of the birth of Aeacus, and states that, in the reign of Aeacus, Hera, jealous of Aegina, ravaged the island bearing the name of the latter by sending a plague or a fearful dragon into it, by which nearly all its inhabitants were carried off, and that Zeus restored the population by changing the ants into men.[9][10][11]
These legends are nothing but a mythical account of the colonization of Aegina, which seems to have been originally in-habited by Pelasgians, and afterwards received colonists from Phthiotis, the seat of the Myrmi-dons, and from Phlius on the Asopus. Aeacus while he reigned in Aegina was renowned in all Greece for his justice and piety, and was fre-quently called upon to settle disputes not only among men, but even among the gods themselves.[12][13] He was such a favourite with the latter, that, when Greece was visited by a drought in consequence of a murder which had been committed, the oracle of Delphi declared that the calamity would not cease unless Aeacus prayed to the gods that it might.[14][2] Aeacus prayed, and it ceased in consequence. Aeacus himself showed his gratitude by erecting a temple to Zeus Panhellenius on mount Panhellenion,[15] and the Aeginetans afterwards built a sanctuary in their island called Aeaceum, which was a square place enclosed by walls of white marble. Aeacus was believed in later times to be buried under the altar in this sacred enclosure.[16]
A legend preserved in Pindar relates that Apollo and Poseidon took Aeacus as their assistant in building the walls of Troy.[17] When the work was completed, three dragons rushed against the wall, and while the two of them which

attacked those parts of the wall built by the gods fell down dead, the third forced its way into the city through the part built by Aeacus. Hereupon Apollo prophesied that Troy would fall through the hands of Aeacus's descandants, the Aeacidae.
Aeacus was also believed by the Aeginetans to have surrounded their island with high cliffs to protect it against pirates.[18]
Several other incidents connected with the story of Aeacus are mentioned by Ovid.[19] By Endeïs Aeacus had two sons, Telamon and Peleus, and by Psamathe a son, Phocus, whom he preferred to the two others, both of whom contrived to kill Phocus during a contest, and then fled from their native island.
After his death, Aeacus became (along with the Cretan brothers Rhadamanthys &Minos) one of the three judges in Hades,[20][21] and accord-ing to Plato especially for the shades of Europeans.[22][23] In works of art he was represented bearing a sceptre and the keys of Hades.[2][24] Aeacus had sanctuaries both at Athens and in Aegina,[16][25][26] and the Aeginetans regarded him as the tutelary deity of their island.[27]
In *The Frogs* (405 BC) by Aristophanes, Dionysus descends to Hades and announces himself as Heracles. Aeacus laments Heracles's theft of Cerberus and sentences Dionysus to Acheron and torment by hounds of Cocytus, Echidna, the Tartesian eel, and Tithrasian Gorgons.

Alexander the Great traced his ancestry (through his mother) to Aeacus.
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• Greek Mythology Link (Carlos Parada) – Aeacus

ast:Éacubs:Eakbr:Aiakosbg:ca:Èaccs:Aiakosde:Aiakosel:es:Éacofr:Éaquehr:Eakit:Eacola:Aeacusko:
lt:Ajakashu:Aiakosznl:Aeacusja:no:Aiakospl:Eakpt:Éacoru:sl:Eaksr:sh:Eakfi:Aiakossv:Aiakosth:tr:Aiakosuk:zh:

ALEXANDRIA TROAS

{{otherusesof}}
Alexandria Troas ("**Alexandria of the Troad**", mod. Eski Stambul) is an ancient Greek city situated on the Aegean Sea near the northern tip of Turkey's western coast, a little south of Tenedos (modern Bozcaada). It is located in the modern Turkish province of Çanakkale.
According to the Catholic Encyclopedia, this site was first called **Sigia**; perhaps about 310 BC Antigonus refounded the city as **Antigonia Troas**. In it's early years, Troas was a port city that supplied the Dorians with recources and trade. The city was conquered by the Helladic people and was nearly destroyed. It was rebuilt arly in the next century and the name was changed by Lysimachus to Alexandria Troas, in memory of Alexander III of Macedon (Pliny, N.H. 5.124 merely states that the name changed from Antigonia to Alexandria). As the chief port of north-west Asia Minor, the place prospered greatly in Roman times, and the existing remains sufficiently attest its former importance. Strabo mentions that a Roman colony was created at the location in the reign of Augustus, named **Colonia Alexandria Augusta Troas** (called simply **Troas** during this period). Augustus, Hadrian and the rich grammarian Herodes Atticus contributed greatly to its embellishment; the aqueduct still preserved is due to the latter. Constantine considered making Troas the capital of the Roman Empire.
In Roman times, it was a significant port for travelling between Anatolia and Europe. Paul of Tarsus sailed for Europe for the first time from Alexandria Troas (Acts, 16:8-11) and returned there from Europe (and there occurred later the episode of the raising

of Eutychus (Acts 20:5–12). Ignatius of Antioch also paused at this city before continuing to his martyrdom at Rome (*Ad Philad.* 11.2; *Ad Smyrn.* 12.1). Several of its later bishops are known: Marinus in 325; Niconius in 344; Sylvanus at the beginning of the fifth century; Pionius in 451; Leo in 787; Peter, friend of the Patriarch Ignatius, and adversary to Michael, in the ninth century. In the tenth century Troas is given as a suffragan of Cyzicus and distinct from the famous Troy (Heinrich Gelzer, *Ungedruckte ... Texte der Notitiae episcopatuum*, 552; *Georgii Cyprii descriptio orbis romani*, 64); it is not known when the city was destroyed and the diocese disappeared. The city remains a titular see of the Roman Catholic Church, *Troadensis*; the seat is vacant following the resignation of the last bishop in 1971. http://www.catholic-hierarchy.org/diocese/d3t88.html
The site {{as of}} was covered with vallonea oaks, and has been much plundered (for example Mehmed IV took columns to adorn his new Valideh mosque in Istanbul), but the circuit of the old walls can be traced, and in several places they are fairly well preserved. They had a circumference of about ten kilometres, and were fortified with towers at regular intervals. Remains of some ancient buildings, including a bath and gymnasium, can be found within this area. Trajan built an aqueduct which can still be traced. The harbour had two large basins, now almost choked with sand.
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{{Second Journey of Paul of Tarsus}}
{{coord missing}}

ca:Alexandria

Troasde:Alexandria

Troases:Alejandría de

Tróadefr:Alexandrie de Troade

CHINESE CHECKERS

{{see}} **Chinese Checkers** is a board game that can be played by two to six people. It is a variant of Halma; the objective of the game is to place one's pieces in the corner opposite their starting position of a pitted hexagram by single moves or jumps over other pieces.
CONTENTS

ESSENTIALS

The Chinese Checkers board has 121 indentations arranged to form a six-pointed star much like a regular hexagram, with ten such spots within each triangular star-point of the hexagram, and 61 within its hexagon. The game pieces are usually six sets of colored pieces (typically marbles), ten of each color. Each set of ten pieces begins placed in the spots of one of the star-points.[1] Play rotates amongst contestants in fixed order, each player making one move before the next player. A piece moves either to an adjacent spot or, by a "jump" over another piece, to a spot two places removed. The objective of the game is to place one's pieces in the opposite corner.
HISTORY

Despite being called "Chinese Checkers", this game does not originate from China or any part of Asia. Chinese Checkers is also not a variation of checkers. The game itself was invented in Germany in 1893 under the name "Stern-Halma", as a variation on the older American game of Halma.[1] The "Stern" (German for *star*) refers to the star-shape of the board (in contrast with the square board of Halma). The *name* "Chinese checkers" originated in the United States, as a marketing scheme by Bill and Jack Pressman in 1928. The Pressman company's game

was originally called "Hop Ching Checkers".
(The game was mostly introduced to Chinese-speaking regions by the Japanese.[1])

HOP ACROSS

Standard jumps can have multiple hops, but each hop must be directly adjacent.
The aim of the game is simply to enter all of one's ten marbles into the opposite "Home base" (star point) on the opposite side of the board before any other player in the game finishes entering his/her pieces likewise.
In the "hop across", most popular variation, each player puts his or her own colored marbles on one of the six points or corners of the star and attempts to relocate them all to the opposite corner. Players take turns moving one marble, either by moving it one single adjacent step or moving a chain of one or any other number of available hops or 'jumps', as they are often called. A step consists of moving a marble to an adjacent unoccupied space in any of the six available directions. In the diagram at right, Green might move the topmost marble diagonally one space down and to the left. A hop consists of jumping directly over a single adjacent marble, either one's own or an opponent's, to the unoccupied space directly over and beyond the adjacent marble. In the diagram at right, Red might advance the indicated marble by a chain of three hops in one single move. It is not mandatory to advance the marble by as many hops as is possible in the chain. In some instances a player may choose to stop the move part way through the chain to impede the opponent's progress or to align their marbles for planned future moves.
Essentially, the basic strategy is to find the longest hopping path that leads closest to, or immediately into, the "home" base (star point) on the opposite side of the board instead of moving step by step, as it obviously requires less moves to finish when using multiple jumps in one single move. However, since one or more players can make use of whatever hopping 'ladders' an opponent creates, more advanced strategy requires a player hindering opposing players in addition to helping himself or herself find jumps across the board. Of equal importance are the players' strategies for emptying and filling their origin and destination triangles. Games between experts are rarely decided by more than a couple of moves.
In the fast-paced variant, which is played mainly in Hong Kong, game pieces may hop over *non-adjacent* pieces. A hop consists of jumping over a distant marble to a symmetrical position on the opposite side. For example, if there are two empty spaces between the moving marble and the marble over which it is hopping, it lands on the opposite side with a gap of two empty spaces. As before, a single move may be a chain of hops, as shown in the diagram at left.
Usually, in the fast paced version, a marble is allowed to enter into an empty corner in the middle of a series of hops but must hop out again before the move is over.
Jumping over two marbles in a single hop is not allowed. Therefore, in this variant even more than in the original version, it is sometimes strategically important to keep one's marbles bunched in order to prevent a long opposing hop.
In a five player game, the situation mimics the six player game except that one player moves toward the unoccupied corner. Because this player is in an advantageous position, usually a weaker player (e.g. a younger child) would take that position.
The four player game is same as the six player game except two opposite corners are unused.
In a three player game, all players play either one or two sets of marbles each. If one set is used, the game pieces are moved across the field into an empty corner. If two sets are used, each player starts with two color sets at opposite

corners.
A typical game board.
In a two player game, each player plays one, two or three sets of marbles. If one set is played, the pieces usually go into the opponent's corner. If two sets are played, the pieces can either go into the player's own opposite corners or into the opponent's corner. If three sets are played, the pieces usually go to the opponent's corners.
Each layout takes different game strategy. For example, if a player's pieces go to that player's own corner, the player can arrange his or her own pieces to serve as bridges between the two opposite ends. On the contrary, if a player's opponent occupies that player's target corner, the player might have to play a waiting game until all of the pieces are moved out.
CAPTURE

In the "capture" variation all sixty game pieces are put in the hexagonal field in the center of the game board. The one hole in the center of the board is left unoccupied so that the game board starts out with a symmetrical hexagonal pattern. The players take turns hopping any game pieces over other game pieces on the board; the hopped over pieces are captured (retired from the game, as in the traditional American incarnation of Checkers) and collected in the player's bin.

At the end of the game, the player with the most captured pieces is the winner. The board is tightly packed at the start of the game; as more pieces are captured, the board frees up and multiple captures can often take place in one move. In this game, two or more players can participate. There is no upper limit to the number of players in this game, but if there are more than six players, not everyone will get a fair turn. The fast-paced version of this game allows the game pieces to catapult over multiple empty spots (just as described in hop-across above). The original version only allows small hops like in checkers.
NOTES

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{{wikibooks}} {{commons}}
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- Chinese Checkers Guide at LearnPlayWin
- History of Halma and Chinese Checkers
- Chinese checkers is played at Thinks.com
- Chinese Checkers is played at Yahoo! Games

cs:ínská dámaes:Damas

chinaseo:Stelhalmaofr:Dames

chinoisesit:Dama cineseja:

pt:Damas

chinesasfi:Kiinanšakkisv:Kinasc

hackzh:

CREED

{{Otheruses4}} A **creed** is a statement of belief — usually religious belief — or faith often recited as part of a religious service. The word derives from the {{lang-la}} for *I believe* and *credimus* for *we believe.* It is sometimes called *symbol* ({{lang-el}}), signifying a "token" by which persons of like beliefs might recognize each other.
The most definitive creed in Christianity is the Nicene Creed, formulated in AD 325 at the First Council of Nicaea, the first of the Twenty One Ecumenical Councils of the Catholic Church.
Affirmation of this creed, which describes the Trinity, is generally taken as a fundamental test of orthodoxy. The Apostle's Creed is also broadly accepted.
Some denominations, including Unitarians, Quakers, Baptists, Messianics, Restorationists, have rejected the authority of those creeds.
Whether Judaism is creedal has been a point of some controversy. Though some say Judaism is noncreedal in nature, others say it recognizes a single creed, the Shema. "Hear O Israel, the Lord is our God, the Lord is One."

Muslims declare the shahada,

"there is no God but Allah, and

Muhammad is his prophet."

The terms "creed" and "faith" are sometimes used to mean religion. Where "creed" appears alongside "religion" or "faith" it can also refer to a person's political or social beliefs.
Pope Paul VI has given the latest Christian creed Sollemni hac liturgia on June 30, 1968.
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APOSTLES' CREED

{{main}}
It is likely that the earliest creed of Christianity that deserves the title in full is the Apostles Creed. Christians attribute this creed to all twelve Apostles as a joint composition, and assigns one phrase of the creed to each Apostle. This attribution is unlikely, but the creed itself is quite old; it seems to have developed from a catechism used in the baptism of adults, and in that form can be traced as far back as the second century (see Old Roman Symbol). The Apostles' Creed seems to have been formulated to resist Docetism and similar ideas associated with Gnosticism; it emphasizes the birth, physical death, and bodily Resurrection of Jesus Christ. Although the Apostles' Creed is accepted by most Western churches, it is not used by the Eastern Orthodox Church.
An English translation of this creed used in the Roman Catholic Church reads:
I believe in God, the Father Almighty, creator of heaven and earth. I believe in Jesus Christ, his only Son, our Lord. He was conceived by the power of the Holy Spirit and born of the Virgin Mary. He suffered under Pontius Pilate, was crucified, died, and was buried. He descended to the dead.On the third day He rose again. He ascended into heaven and is seated at the right hand of the Father. He will come again to judge the living and the dead. I believe in the Holy Spirit, the Holy Catholic Church, the communion of Saints, the forgiveness of sins, the resurrection of the body, and the life everlasting. AMEN.
NICENE CREED

{{main}}
The Nicene Creed is clearly derived from the Apostles' Creed, and equally obviously represents an elaboration of its basic themes. The most salient additions to this creed are much more elaborate statements concerning Christology and the Trinity. These reflect the concerns of the First Council of Nicaea in 325, and have their chief purpose the rejection of Arianism, which the church judged a heresy. In the Roman Catholic, Anglican, and Eastern Orthodox liturgies, the Nicene Creed is repeated during each Mass (Eucharist) on Sundays and High Days.
The Nicene Creed is the only true "universal creed," accepted by almost all mainstream Christian churches of both the Western and Eastern traditions with the sole difference of the Filioque clause.
A CREED AS A DENIAL OF HERESIES

In an atmosphere of increasingly complicated theological controversy, orthodox belief might become more complicated in outline. In the decade before 594, Gregory, bishop of Tours set out to write a "History of the Franks". In Gaul, a part of Europe recently beset with both royal Arians and pagans (until the conversion of Clovis), Gregory prefaced his history with a declaration of his faith, "so that my reader may have no doubt that I am Catholic for they are (Book I.i). The confession is in many phrases, each of which refutes a specific Christian heresy. Thus Gregory's creed presents, in negative, a virtual litany of heresies:
I believe, then, in God the Father omnipotent. I believe in Jesus Christ his only Son, our Lord God, born of the Father, not created. [I believe] that he

has always been with the Father, not only since time began but before all time. For the Father could not have been so named unless he had a son; and there could be no son without a father. But as for those who say: "There was a time when he was not", [note: A leading belief of Arian Christology.] I reject them with curses, and call men to witness that they are separated from the church. I believe that the word of the Father by which all things were made was Christ. I believe that this word was made flesh and by its suffering the world was redeemed, and I believe that humanity, not deity, was subject to the suffering. I believe that he rose again on the third day, that he freed sinful man, that he ascended to heaven, that he sits on the right hand of the Father, that he will come to judge the living and the dead. I believe that the Holy Spirit proceeded from the Father and the Son, that it is not inferior and is not of later origin, but is God, equal and always co-eternal with the Father and the Son, consubstantial in its nature, equal in omnipotence, equally eternal in its essence, and that it has never existed apart from the Father and the Son and is not inferior to the Father and the Son. I believe that this holy Trinity exists with separation of persons, and one person is that of the Father, another that the Son, another that of the Holy Spirit. And in this Trinity confess that there is one Deity, one power, one essence. I believe that the blessed Mary was a virgin after the birth as she was a virgin before. I believe that the soul is immortal but that nevertheless it has no part in deity. And I faithfully believe all things that were established at Nicæa by the three hundred and eighteen bishops. But as to the end of the world I hold beliefs which I learned from our forefathers, that Antichrist will come first. An Antichrist will first propose circumcision, asserting that he is Christ; next he will place his statue in the temple at Jerusalem to be worshipped, just as we read that the Lord said: "You shall see the abomination of desolation standing in the holy place." But the Lord himself declared that that day is hidden from all men, saying; "But of that day and that hour knoweth no one not even the angels in heaven, neither the Son, but the Father alone." Moreover we shall here make answer to the heretics [note: the Arians] who attack us, asserting that the Son is inferior to the Father since he is ignorant of this day. Let them learn then that Son here is the name applied to the Christian people, of whom God says: "I shall be to them a father and they shall be to me for sons." For if he had spoken these words of the only- begotten Son he would never have given the angels first place. For he uses these words: "Not even the angels in heaven nor the Son", showing that he spoke these words not of the only-begotten but of the people of adoption. But our end is Christ himself, who will graciously bestow eternal life on us if we turn to him."

http://www.fordham.edu/halsall/basis/gregory-hist.html#book3

CHRISTIANS WITHOUT CREEDS

{{main}}

Some Christian denominations, and particularly those descending from the Radical Reformation, do not profess a creed.

Unitarian Christians have long rejected creedal tests, recalling how the early creeds were formulated in the fourth century following the union of Church and State under Constantine, and were employed thereafter to persecute Unitarians for deviating from the Trinitarian orthodoxy that the creeds established. Michael Servetus, for example, was burnt at the stake in 1553 for deviating from the Trinitarian doctrines expressed in the Nicene and Athanasian creeds. In England,

the Trinitarian creeds produced anti-Unitarian penal statutes that remained on the books until 1813.

The Quakers, formally known as the Religious Society of Friends, find no need for creedal formulations of faith. The Church of the Brethren also espouses no creed, referring to the New Testament, as their "rule of faith and practice."

Many evangelical Protestants similarly reject creeds as definitive statements faith, even while agreeing with some creeds' substance. The Baptists, for example, have no formal creed and do not empower the church to define one. Even so, they are generally in agreement with the Nicene Creed's substance.

The same may be said of the Restoration Movement and its descendants, the Christian Church (Disciples of Christ), the Churches of Christ, and the Independent Christian Churches/Churches of Christ.

Some religious leaders have come to question the utility of creeds. Bishop John Shelby Spong, who in the year 2000 retired as the Episcopal Bishop of Newark, has written that dogmas and creeds were merely "a stage in our development" and "part of our religious childhood." In his book *Sins of the Scripture* Spong suggested that "Jesus seemed to understand that no one can finally fit the holy God into his or her creeds or doctrines. That is idolatry."

JEWISH CREED

Whether Judaism is creedal in character has generated some controversy.

Rabbi Milton Steinberg wrote that "By its nature Judaism is averse to formal creeds which of necessity limit and restrain thought" and asserted in his book *Basic Judaism* (1947) that "Judaism has never arrived at a creed." The 1976 Centenary Platform of the Central Conference of American Rabbis, an organization of Reform Jewish rabbis agrees that "Judaism emphasizes action rather than creed as the primary expression of a religious life."

Others, however, characterize the Shema Yisrael as creedal statement of faith in strict, monolithic monotheism embodied in a single prayer to be recited twice daily: "Hear O Israel, the Lord is our God, the Lord is One" ({{lang-he}}; transliterated *Shema Yisrael Adonai Eloheinu Adonai Echad*.)

ISLAMIC CREED

The Islamic creed is the Shahadah, the proclamation that "I testify that there is no god (*ilah*) but God (*Allah*), and I testify that Muhammad is the messenger of God."

OTHER CREEDS

Other notable creeds include the:

- Athanasian Creed
- Chalcedonian Creed
- Social Creed (Methodist)
- Masai Creed
- Bodhisattva vows (Buddhism)
- International Creed for Peace
- Personal Creed (such as Frank Martin's "rules")

SEE ALSO

- American's Creed
- Articles of Faith
- Assassin's Creed
- Book of Concord
- Pledge of Allegiance
- Thirty-Nine Articles
- Westminster Confession of Faith

FURTHER READING

- *Creeds and Confessions of Faith in the Christian Tradition*. Edited by Jaroslav Pelikan and Valerie Hotchkiss. Published by Yale University Press in 2003.

EXTERNAL LINKS

- *The Creeds of Christendom* – A website linking to many formal Christian declarations of faith.
- *Creeds and Canons* – A Guide to Early Church Documents from Internet Christian Library
- ICP Website International Creed for Peace

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ARBITRAGE

In economics and finance, **arbitrage** is the practice of taking advantage of a price differential between two or more markets: striking a combination of matching deals that capitalize upon the imbalance, the profit being the difference between the market prices. When used by academics, an arbitrage is a transaction that involves no negative cash flow at any probabilistic or temporal state and a positive cash flow in at least one state; in simple terms, a risk-free profit. A person who engages in arbitrage is called an **arbitrageur** – such as a bank or brokerage firm. The term is mainly applied to trading in financial instruments, such as bonds, stocks, derivatives, commodities and currencies. If the market prices do not allow for profitable arbitrage, the prices are said to constitute an **arbitrage equilibrium** or **arbitrage-free** market. An arbitrage equilibrium is a precondition for a general economic equilibrium. The assumption that there is no arbitrage is used in quantitative finance to calculate a unique risk neutral price for derivatives.

Statistical arbitrage is an imbalance in expected nominal values. A casino has a statistical arbitrage in almost every game of chance that it offers – referred to as the house advantage, house edge, vigorish or house vigorish.

CONTENTS

CONDITIONS FOR ARBITRAGE

Arbitrage is possible when one of three conditions is met:

1. The same asset does not trade at the same price on all markets ("the law of one price").
2. Two assets with identical cash flows do not trade at the same price.
3. An asset with a known price in the future does not today trade at its future price discounted at the risk-free interest rate (or, the asset does not have negligible costs of storage; as such, for example, this condition holds for grain but not for securities).

Arbitrage is not simply the act of buying a product in one market and selling it in another for a higher price at some later time. The transactions must occur *simultaneously* to avoid exposure to market risk, or the risk that prices may change on one market before both transactions are complete. In practical terms, this is generally only possible with securities and financial products which can be traded electronically.

In the most simple example, any good sold in one market should sell for the same price in another. Traders may, for example, find that the price of wheat is lower in agricultural regions than in cities, purchase the good, and transport it to another region to sell at a higher price. This type of price arbitrage is the most common, but this simple example ignores

the cost of transport, storage, risk, and other factors. "True" arbitrage requires that there be no market risk involved. Where securities are traded on more than one exchange, arbitrage occurs by simultaneously buying in one and selling on the other. See rational pricing, particularly arbitrage mechanics, for further discussion.
Mathematically it is defined as follows:
$P(V_T \geq 0) = 1$ and $P(V_T \neq 0) > 0$
where V_t means a portfolio at time t.
EXAMPLES

- Suppose that the exchange rates (after taking out the fees for making the exchange) in London are £5 = $10 = ¥1000 and the exchange rates in Tokyo are ¥1000 = $12 = £6. Converting ¥1000 to $12 in Tokyo and converting that $12 into ¥1200 in London, for a profit of ¥200, would be arbitrage. In reality, this "triangle arbitrage" is so simple that it almost never occurs. But more complicated foreign exchange arbitrages, such as the spot-forward arbitrage (see interest rate parity) are much more common.
- One example of arbitrage involves the New York Stock Exchange and the Chicago Mercantile Exchange. When the price of a stock on the NYSE and its corresponding futures contract on the CME are out of sync, one can buy the less expensive one and sell it to the more expensive market. Because the differences between the prices are likely to be small (and not to last very long), this can only be done profitably with computers examining a large number of prices and automatically exercising a trade when the prices are far enough out of balance. The activity of other arbitrageurs can make this risky. Those with the fastest computers and the smartest mathematicians take advantage of series of small differentials that would not be profitable if taken individually.
- Economists use the term "global labor arbitrage" to refer to the tendency of manufacturing jobs to flow towards whichever country has the lowest wages per unit output at present and has reached the minimum requisite level of political and economic development to support industrialization. At present, many such jobs appear to be flowing towards China, though some which require command of English are going to India and the Philippines. In popular terms, this is referred to as offshoring. (Note that "offshoring" is not synonymous with "outsourcing", which means "to subcontract from an outside supplier or source", such as when a business outsources its bookkeeping to an accounting firm. Unlike offshoring, outsourcing always involves subcontracting jobs to a different company, and that company can be in the same country as the outsourcing company.)
- Sports arbitrage - numerous internet bookmakers offer odds on the outcome of the same event. Any given bookmaker will weight their odds so that no one customer can cover all outcomes at a profit against their books. However, in order to remain competitive their margins are usually quite low. Different bookmakers may offer different odds on the same outcome of a given event; by taking the best odds offered by each bookmaker, a customer can under some circumstances cover all possible outcomes of the event and lock a small risk-free profit, known as a Dutch book. This profit would typically be between 1% and 5% but can be much higher. One problem with sports arbitrage is that bookmakers sometimes make mistakes and this can lead to an invocation of the 'palpable error' rule, which most bookmakers invoke when they have made a mistake by offering or posting incorrect odds. As bookmakers become more proficient, the odds of making an 'arb' usually last for less than an hour and typically

only a few minutes. Furthermore, huge bets on one side of the market also alert the bookies to correct the market.

- Exchange-traded fund arbitrage - Exchange Traded Funds allow authorized participants to exchange back and forth between shares in underlying securities held by the fund and shares in the fund itself, rather than allowing the buying and selling of shares in the ETF directly with the fund sponsor. ETFs trade in the open market, with prices set by market demand. An ETF may trade at a premium or discount to the value of the underlying assets. When a significant enough premium appears, an arbitrageur will buy the underlying securities, convert them to shares in the ETF, and sell them in the open market. When a discount appears, an arbitrageur will do the reverse. In this way, the arbitrageur makes a low-risk profit, while fulfilling a useful function in the ETF marketplace by keeping ETF prices in line with their underlying value.
- Some types of hedge funds make use of a modified form of arbitrage to profit. Rather than exploiting price differences between identical assets, they will purchase and sell securities, assets and derivatives with similar characteristics, and hedge any significant differences between the two assets. Any difference between the hedged positions represents any remaining risk (such as basis risk) plus profit; the belief is that there remains some difference which, even after hedging most risk, represents pure profit. For example, a fund may see that there is a substantial difference between U.S. dollar debt and local currency debt of a foreign country, and enter into a series of matching trades (including currency swaps) to arbitrage the difference, while simultaneously entering into credit default swaps to protect against country risk and other types of specific risk.

PRICE CONVERGENCE

Arbitrage has the effect of causing prices in different markets to converge. As a result of arbitrage, the currency exchange rates, the price of commodities, and the price of securities in different markets tend to converge to the same prices, in all markets, in each category. The speed at which prices converge is a measure of market efficiency. Arbitrage tends to reduce price discrimination by encouraging people to buy an item where the price is low and resell it where the price is high, as long as the buyers are not prohibited from reselling and the transaction costs of buying, holding and reselling are small relative to the difference in prices in the different markets. Arbitrage moves different currencies toward purchasing power parity. As an example, assume that a car purchased in the United States is cheaper than the same car in Canada. Canadians would buy their cars across the border to exploit the arbitrage condition. At the same time, Americans would buy US cars, transport them across the border, and sell them in Canada. Canadians would have to buy American Dollars to buy the cars, and Americans would have to sell the Canadian dollars they received in exchange for the exported cars. Both actions would increase demand for US Dollars, and supply of Canadian Dollars, and as a result, there would be an appreciation of the US Dollar. Eventually, if unchecked, this would make US cars more expensive for all buyers, and Canadian cars cheaper, until there is no longer an incentive to buy cars in the US and sell them in Canada. More generally, international arbitrage opportunities in commodities, goods, securities and currencies, on a grand scale, tend to change exchange rates until the purchasing power is equal.

In reality, of course, one must consider taxes and the costs of travelling back and forth between the US and Canada. Also, the features built into the cars sold in the US are not exactly the same as the features built into the cars for sale in

Canada, due, among other things, to the different emissions and other auto regulations in the two countries. In addition, our example assumes that no duties have to be paid on importing or exporting cars from the USA to Canada. Similarly, most assets exhibit (small) differences between countries, transaction costs, taxes, and other costs provide an impediment to this kind of arbitrage.

Similarly, arbitrage affects the difference in interest rates paid on government bonds, issued by the various countries, given the expected depreciations in the currencies, relative to each other (see interest rate parity).

RISKS

Arbitrage transactions in modern securities markets involve fairly low risks. Generally it is impossible to close two or three transactions at the same instant; therefore, there is the possibility that when one part of the deal is closed, a quick shift in prices makes it impossible to close the other at a profitable price. There is also counter-party risk, that the other party to one of the deals fails to deliver as agreed; though unlikely, this hazard is serious because of the large quantities one must trade in order to make a profit on small price differences. These risks become magnified when leverage or borrowed money is used.

Another risk occurs if the items being bought and sold are not identical and the arbitrage is conducted under the assumption that the prices of the items are correlated or predictable. In the extreme case this is risk arbitrage, described below. In comparison to the classical quick arbitrage transaction, such an operation can produce disastrous losses. Competition in the marketplace can also create risks during arbitrage transactions. As an example, if one was trying to profit from a price discrepancy between IBM on the NYSE and IBM on the London Stock Exchange, they may purchase a large number of shares on the NYSE and find that they cannot simultaneously sell on the LSE. This leaves the arbitrageur in an unhedged risk position.

In the 1980s, risk arbitrage was common. In this form of speculation, one trades a security that is clearly undervalued or overvalued, when it is seen that the wrong valuation is about to be corrected by events. The standard example is the stock of a company, undervalued in the stock market, which is about to be the object of a takeover bid; the price of the takeover will more truly reflect the value of the company, giving a large profit to those who bought at the current price—if the merger goes through as predicted. Traditionally, arbitrage transactions in the securities markets involve high speed and low risk. At some moment a price difference exists, and the problem is to execute two or three balancing transactions while the difference persists (that is, before the other arbitrageurs act). When the transaction involves a delay of weeks or months, as above, it may entail considerable risk if borrowed money is used to magnify the reward through leverage. One way of reducing the risk is through the illegal use of inside information, and in fact risk arbitrage with regard to leveraged buyouts was associated with some of the famous financial scandals of the 1980s such as those involving Michael Milken and Ivan Boesky.

TYPES OF ARBITRAGE

MERGER ARBITRAGE

Also called risk arbitrage, merger arbitrage generally consists of buying the stock of a company that is the target of a takeover while shorting the stock of the acquiring company.

Usually the market price of the target company is less than the price offered by the acquiring company. The spread between these two prices depends mainly on the probability and the timing of the takeover being completed as well as the prevailing level of interest rates. The bet in a merger arbitrage is that such a spread will eventually be zero, if and when

the takeover is completed. The risk is that the deal "breaks" and the spread massively widens.

MUNICIPAL BOND ARBITRAGE

Also called *municipal bond relative value arbitrage*, *municipal arbitrage*, or just *muni arb*, this hedge fund strategy involves one of two approaches.

Generally, managers seek relative value opportunities by being both long and short municipal bonds with a duration-neutral book. The relative value trades may be between different issuers, different bonds issued by the same entity, or capital structure trades referencing the same asset (in the case of revenue bonds). Managers aim to capture the inefficiencies arising from the heavy participation of non-economic investors (i.e., high income "buy and hold" investors seeking tax-exempt income) as well as the "crossover buying" arising from corporations' or individuals' changing income tax situations (i.e., insurers switching their munis for corporates after a large loss as they can capture a higher after-tax yield by offsetting the taxable corporate income with underwriting losses). There are additional inefficiencies arising from the highly fragmented nature of the municipal bond market which has two million outstanding issues and 50,000 issuers in contrast to the Treasury market which has 400 issues and a single issuer.

Second, managers construct leveraged portfolios of AAA- or AA-rated tax-exempt municipal bonds with the duration risk hedged by shorting the appropriate ratio of taxable corporate bonds. These corporate equivalents are typically interest rate swaps referencing Libor http://en.wikipedia.org/wiki/Libor#LIBOR-based_derivatives or SIFMA(Security Industry and Financial Markets Association)http://www.investinginbonds.com/story.asp?id=351 (merged with and preceded by BMA (short for Bond Market Association]) http://www.bondmarkets.com/story.asp?id=1157). The arbitrage manifests itself in the form of a relatively cheap longer maturity municipal bond, which is a municipal bond that yields significantly more than 65% of a corresponding taxable corporate bond. The steeper slope of the municipal yield curve allows participants to collect more after-tax income from the municipal bond portfolio than is spent on the interest rate swap; the carry is greater than the hedge expense. Positive, tax-free carry from muni arb can reach into the double digits. The bet in this municipal bond arbitrage is that, over a longer period of time, two similar instruments--municipal bonds and interest rate swaps--will correlate with each other; they are both very high quality credits, have the same maturity and are denominated in U.S. dollars. Credit risk and duration risk are largely eliminated in this strategy. However, basis risk arises from use of an imperfect hedge, which results in significant, but range-bound principal volatility. The end goal is to limit this principal volatility, eliminating its relevance over time as the high, consistent, tax-free cash flow accumulates. Since the inefficiency is related to government tax policy, and hence is structural in nature, it has not been arbitraged away.

CONVERTIBLE BOND ARBITRAGE

A convertible bond is a bond that an investor can return to the issuing company in exchange for a predetermined number of shares in the company.

A convertible bond can be thought of as a corporate bond with a stock call option attached to it.

The price of a convertible bond is sensitive to three major factors:

- *interest rate*. When rates move higher, the bond part of a convertible bond tends to move lower, but the call option part of a convertible bond moves higher (and the aggregate tends to move lower).
- *stock price*. When the price of

the stock the bond is convertible into moves higher, the price of the bond tends to rise.

- *credit spread*. If the creditworthiness of the issuer deteriorates (e.g. rating downgrade) and its credit spread widens, the bond price tends to move lower, but, in many cases, the call option part of the convertible bond moves higher (since credit spread correlates with volatility).

Given the complexity of the calculations involved and the convoluted structure that a convertible bond can have, an arbitrageur often relies on sophisticated quantitative models in order to identify bonds that are trading cheap versus their theoretical value.

Convertible arbitrage consists of buying a convertible bond and hedging two of the three factors in order to gain exposure to the third factor at a very attractive price.

For instance an arbitrageur would first buy a convertible bond, then sell fixed income securities or interest rate futures (to hedge the interest rate exposure) and buy some credit protection (to hedge the risk of credit deterioration).

Eventually what he'd be left with is something similar to a call option on the underlying stock, acquired at a very low price. He could then make money either selling some of the more expensive options that are openly traded in the market or delta hedging his exposure to the underlying shares.

DEPOSITORY RECEIPTS

A depository receipt is a security that is offered as a "tracking stock" on another foreign market. For instance a Chinese company wishing to raise more money may issue a depository receipt on the New York Stock Exchange, as the amount of capital on the local exchanges is limited. These securities, known as ADRs (American Depositary Receipt) or GDRs (Global Depositary Receipt) depending on where they are issued, are typically considered "foreign" and therefore trade at a lower value when first released. However, they are exchangeable into the original security (known as fungibility) and actually have the same value. In this case there is a spread between the perceived value and real value, which can be extracted. Since the ADR is trading at a value lower than what it is worth, one can purchase the ADR and expect to make money as its value converges on the original. However there is a chance that the original stock will fall in value too, so by shorting it you can hedge that risk.

DUAL-LISTED COMPANIES

A dual-listed company (DLC) structure involves two companies incorporated in different countries contractually agreeing to operate their businesses as if they were a single enterprise, while retaining their separate legal identity and existing stock exchange listings. In integrated and efficient financial markets, stock prices of the twin pair should move in lockstep. In practice, DLC share prices exhibit large deviations from theoretical parity. Arbitrage positions in DLCs can be set-up by obtaining a long position in the relatively underpriced part of the DLC and a short position in the relatively overpriced part. Such arbitrage strategies start paying off as soon as the relative prices of the two DLC stocks converge toward theoretical parity. However, since there is no identifiable date at which DLC prices will converge, arbitrage positions sometimes have to be kept open for considerable periods of time. In the meantime, the price gap might widen. In these situations, arbitrageurs may receive margin calls, after which they would most likely be forced to liquidate part of the position at a highly unfavorable moment and suffer a loss. Arbitrage in DLCs may be profitable, but is also very risky, see [1].

Background material is available at http://mathijsavandijk.com/dual-listed-companies/.

A good illustration of the risk

of DLC arbitrage is the position in Royal Dutch Shell – which had a DLC structure until 2005 – by the hedge fund Long-Term Capital Management (LTCM, see also the discussion below). Lowenstein (2000) [2] describes that LTCM established an arbitrage position in Royal Dutch Shell in the summer of 1997, when Royal Dutch traded at an 8 to 10 percent premium. In total $2.3 billion was invested, half of which long in Shell and the other half short in Royal Dutch (Lowenstein, p. 99). In the autumn of 1998 large defaults on Russian debt created significant losses for the hedge fund and LTCM had to unwind several positions. Lowenstein reports that the premium of Royal Dutch had increased to about 22 percent and LTCM had to close the position and incur a loss. According to Lowenstein (p. 234), LTCM lost $286 million in equity pairs trading and more than half of this loss is accounted for by the Royal Dutch Shell trade.

REGULATORY ARBITRAGE

{{details}} Regulatory arbitrage is where a regulated institution takes advantage of the difference between its real (or economic) risk and the regulatory position. For example, if a bank, operating under the Basel I accord, has to hold 8% capital against default risk, but the real risk of default is lower, it is profitable to securitise the loan, removing the low risk loan from its portfolio. On the other hand, if the real risk is higher than the regulatory risk then it is profitable to make that loan and hold on to it, provided it is priced appropriately.

This process can increase the overall riskiness of institutions under a risk insensitive regulatory regime, as described by Alan Greenspan in his October 1998 speech on The Role of Capital in Optimal Banking Supervision and Regulation.

In economics, regulatory arbitrage (sometimes, tax arbitrage) may be used to refer to situations when a company can choose a nominal place of business with a regulatory, legal or tax regime with lower costs. For example, an insurance company may choose to locate in Bermuda due to preferential tax rates and policies for insurance companies. This can occur particularly where the business transaction has no obvious physical location: in the case of many financial products, it may be unclear "where" the transaction occurs.

Regulatory arbitrage can include restructuring a bank by outsourcing services such as IT. The outsourcing company takes over the installations, buying out the bank's assets and charges a periodic service fee back to the bank. This frees up cashflow usable for new lending by the bank. The bank will have higher IT costs, but counts on the multiplier effect of money creation and the interest rate spread to make it a profitable exercise.

Example Sell the IT installations for 40 million USD. With a reserve ratio of 10%, the bank can create 400 million in additional loans (there is a time lag, and the bank has to expect to recover the loaned money back into its books). The bank can often lend (and securitize the loan) to the IT services company their acquisition cost for the IT installations. This can be at preferential rates, as the sole client using the IT installation is the bank. If the bank can generate 5% interest margin on the 400 million of new loans, the bank will increase interest revenues by 20 million. The IT services company is free to leverage their balance sheet as aggressively as they and their banker agree to. This is the reason behind the trend towards outsourcing in the financial sector. It is actually more expensive to outsource the IT operations as the outsourcing adds a layer of management and increases overhead.

TELECOM ARBITRAGE

{{main}}

Telecom arbitrage companies allow phone users to make international calls for free

through certain access numbers. Such services are offered in the United Kingdom; the telecommunication arbitrage companies get paid an interconnect charge by the UK mobile networks and then buy international routes at a lower cost. The calls are seen as free by the UK contract mobile phone customers since they are using up their allocated monthly minutes rather than paying for additional calls. Such services were previously offered in the United States by companies such as FuturePhone.com. [3] These services would operate in rural telephone exchanges, primarily in small towns in the state of Iowa. In these areas, the local telephone carriers are allowed to charge a high "termination fee" to the caller's carrier in order to fund the cost of providing service to the small and sparsely-populated areas that they serve. However, FuturePhone (as well as other similar services) ceased operations upon legal challenges from AT&T and other service providers. [4]

THE DEBACLE OF LONG-TERM CAPITAL MANAGEMENT

{{main}}

Long-Term Capital Management (LTCM) lost 4.6 billion U.S. dollars in fixed income arbitrage in September 1998. LTCM had attempted to make money on the price difference between different bonds. For example, it would sell U.S. Treasury securities and buy Italian bond futures. The concept was that because Italian bond futures had a less liquid market, in the short term Italian bond futures would have a higher return than U.S. bonds, but in the long term, the prices would converge. Because the difference was small, a large amount of money had to be borrowed to make the buying and selling profitable.

The downfall in this system began on August 17, 1998, when Russia defaulted on its ruble debt and domestic dollar debt. Because the markets were already nervous due to the Asian financial crisis, investors began selling non-U.S. treasury debt and buying U.S. treasuries, which were considered a safe investment. As a result the price on US treasuries began to increase and the return began decreasing because there were many buyers, and the return on other bonds began to increase because there were many sellers. This caused the difference between the prices of U.S. treasuries and other bonds to increase, rather than to decrease as LTCM was expecting. Eventually this caused LTCM to fold, and their creditors had to arrange a bail-out. More controversially, officials of the Federal Reserve assisted in the negotiations that led to this bail-out, on the grounds that so many companies and deals were intertwined with LTCM that if LTCM actually failed, they would as well, causing a collapse in confidence in the economic system. Thus LTCM failed as a fixed income arbitrage fund, although it is unclear what sort of profit was realized by the banks that bailed LTCM out.

ETYMOLOGY

{{wiktionary}} "Arbitrage" is a French word and denotes a decision by an arbitrator or arbitration tribunal. (In modern French, "*{{lang}}*" usually means referee or umpire). In the sense used here it is first defined in 1704 by Mathieu de la Porte in his treatise "{{lang}}" as a consideration of different exchange rates to recognize the most profitable places of issuance and settlement for a bill of exchange ("{{lang}}"). [5]

SEE ALSO

- Arbitrage betting
- Arbitrage pricing theory
- Covered interest arbitrage
- Efficient market hypothesis
- Immunization (finance)
- Interest rate parity

•Political arbitrage
•Statistical arbitrage
•TANSTAAFL
•Triangle arbitrage
•Uncovered interest arbitrage
•Value investing
•Volatility arbitrage
•Fixed income arbitrage
•Algorithmic Trading Platforms
•Coherence (philosophical gambling strategy), analogous concept in Bayesian probability

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2. Lowenstein, R., 2000, When genius failed: The rise and fall of Long-Term Capital Management, Random House.
3. {{cite web}}
4. {{cite web}}
5. See "Arbitrage" in Trésor de la Langue Française.

•Greider, William (1997). *One World, Ready or Not.* Penguin Press. ISBN 0-7139-9211-5.
•*Special Situation Investing: Hedging, Arbitrage, and Liquidation*, Brian J. Stark, Dow-Jones Publishers. New York, NY 1983. ISBN-10: 0870943847; ISBN-13: 9780870943843

EXTERNAL LINKS

• What is Arbitrage? (About.com)
•ArbitrageView.com - Arbitrage opportunities in pending merger deals in the U.S. market
•Information on arbitrage in dual-listed companies on the website of Mathijs A. van Dijk.

ar: cs:Arbitráž (finance)de:Arbitrageel:es:Arbitraje (economía)fr:Arbitrage (finance)id:Arbitrasiit:Arbitraggiohe:'nl:Arbitrage (handel)ja: no:Arbitrasjepl:Arbitra (ekonomia)pt:Arbitragem (economia)ru: fi:Arbitraasisv:Arbitragetr:Arbitrajzh:

ANALOG BROTHERS

{{Infobox musical artist}}
Analog Brothers is an experimental hip-hop crew featuring Ice Oscillator also known as Ice-T (keyboards, drums, vocals), Keith Korg also known as Kool Keith (bass, strings, vocals), Mark Moog also known as Marc Live (drums, *violyns* and vocals), Silver Synth also known as Black Silver (synthesizer, lazar bell and vocals), and Rex Roland also known as Pimp Rex (keyboards, vocals, production). Its album *Pimp to Eat* featured guest appearances by various members of Rhyme Syndicate, Odd Oberheim, Jacky Jasper (who appears as Jacky Jasper on the song "We Sleep Days" and H-Bomb on "War"), D.J. Cisco from S.M., the Synth-a-Size Sisters and Teflon.
While the group only recorded one album together as the Analog Brothers, a few bootlegs of its live concert performances, including freestyles with original lyrics, have occasionally surfaced online. After *Pimp to Eat*, the Analog Brothers continued performing together in various line ups. Kool Keith and Marc Live joined with Jacky Jasper to release two albums as KHM. Marc Live rapped with Ice T's group SMG. Marc also formed a group with Black Silver called Live Black, but while five of their tracks were released on a demo CD sold at concerts, Live Black's first album has yet to be released.
In addition to all this, the Analog Brothers continue to make frequent appearances on each other's solo albums.

DISCOGRAPHY

•*2005. A.D.* (single) (2000)
•*Pimp to Eat* (Ground Control/Nu Gruv) (2000)

EXTERNAL LINKS

• Kool Keith's Site
•{{AMG Artist}}
•Analog Brothers at Discogs
{{Ice-T}} {{Kool Keith}} {{US-hiphop-band-stub}}