A Primer on Knots, Hitches, and Bends [1]

The term knot is used generically to cover knots, hitches, and bends. It was done so here. Technically, knots, hitches and bends are structurally different and serve different purposes. In addition, the three types of knots indicate three basic knot tying situations. The rope is fasten to another object (i.e. hitch). It is fasten to another rope (i.e. bend). Or it is a self-supporting knot in the rope that creates a loop or serves some other function. Along with principles and definitions, the three types of knots are used as the organizational structure and headings in this section.

Principles and Definitions

Knot – The critical element in determining a knot is that when tied, it is self-contained and self-supporting. A simple overhand knot or figure-8 knot is self-supporting in that the configuration of the knot and how it is tied supports itself as a knot. Unlike a hitch, a knot does not need another rope or object to maintain the integrity of its configuration. Unlike a bend, a knot doesn't need another rope to maintain the integrity of its configuration when two ropes are tied together.

Also, it should be noted that the term knot is often the generic term used for hitches and bends much like Zerox ® is synonymous with copying and used interchangeably with all copying. Similarly, Kleenex is synonymous with tissue paper and used interchangeably with it. So generic is the use of knot as part of the nomenclature, obvious hitches such as the water knot, grapevine knot, or barrel knot are actually called knots. This section recognizes the difference between knots, hitches, and bends. It is structured along these distinctions. However, the term knot is used generically and interchangeably with hitch and bends.

Hitch – Without another rope or object to assist in maintaining its integrity and configuration, a hitch will fall apart. In this respect, a hitch is not self-contained nor is it self-supporting. Without a peg or object, a clove hitch will fall apart. The same is true for a Prusik which is listed under the hitches. It needs another rope to tie and to maintain its integrity and configuration.

Bends – Bends are used to tie two ropes together. The water knot is used to tie two the two ends of webbing together to create a sling. Also, the water knot is labeled as a knot rather than a bend indicating the confusion often associated with the terms used.

Families – Examination of knots reveals that their internal structure tends to repeat themself in other knots. This suggests that knots can be grouped into families. Also, this helps when examining knots because the configurations are the same. The figure eight family of knots is probably the largest family of knots. The bowline and sheetbend have identical configurations. Two half-hitches and the clove hitch are the configurations.

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[1] This section was written by Robert B. Kauffman who is solely responsible for its content. Robert B. Kauffman, Professor of Recreation and Parks Management, Frostburg State University, Frostburg, MD 21532. e: rkauffman@frostburg.edu.

Families can be extended to include similar configurations but where the number of loops or other element is varied in the knot. The single, double, and triple fishermen knots (hitches) have the same configuration except for the number of loops. The double sheetbend is similar to the sheetbend, except that it has a second internal loop. The figure nine knot has one more turn than a figure eight knot. An overhand knot has one less turn than a figure eight knot.

The conclusion is that many knots have much in common with each other. There are only so many ways to tie them.

Parts of a Rope (Figure 15.1) – The following are some commonly used rope terms. It is useful in orientating and describing the parts of a rope as well as working with a rope. Some of the terminology seemingly overlaps with other terms, such as the difference between a bight and loop.

Bight – A bight is a loop where the line doesn't cross over itself. The rope forming the loop remain ssentially parallel to each other. It is usually taken out of the center of the rope.

Loop – In contrast with a bight, a loop is a turn in the rope where the lines cross over each other. When tying a bowline, the first step is to make a loop.

Working End – The working end is attached to item being rigged or hauled. Think of it as the end of the rope working or currently occupied.

Standing End – The standing part of a rope includes all the rope excluding the working end.

Running End – The running end is the free end of the rope. It is part of the standing end of the rope and it is the section of the running end of the rope used to tie a knot or hitch to something else.

Tying Considerations – Some knots are selected because of their strength (e.g. figure-8). Some are chosen because a life might depend on the knot being "bombproof" (e.g. figure-8 on a bight). Some knots are selected because they can be tied and untied quickly (e.g. bowline). Others have a specific purpose or functions (e.g. double fisherman, Prusik).

Function – Many knots are designed for specific uses and functions. A sheetbend and double fisherman are designed to tie two ropes together. A water knot is designed to tie two pieces of webbing together but not two ropes. A bowline is designed to tie a loop in the rope. A clove hitch is designed to tie a rope to a branch or peg.

Strength (Figure 15.2) – Tie a knot in a rope and it will immediately lose 1/4 to ½ of its strength. The knot creates a stress point where the fibers on the outside of the bend in the knot are stressed more than those on the inside of the bend. This creates a stress point and leads to rope failure at this point.

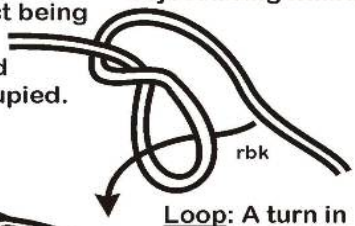
Ease to Tie/Untie – A knot should be relatively easy to tie. When tying a line around a post or object, the bowline is easier and quicker to tie than a figure-8 follow-through.

Often overlooked is the ability to easily untie a knot. A bowline is easy to untie even after heavy loading. Just bend the "horse collar" section of the knot over the working end of the rope and the knot will fall apart. In contrast, considerable labor and time can be extended trying to untie a double fisherman.

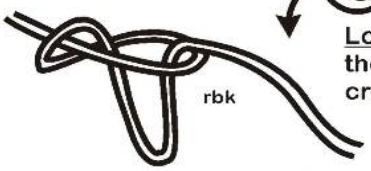
Parts of a Rope
Figure 15.1

Working End: The end tied off to object being hauled (not shown). It is end working or occupied.

Standing End: All the rope not fasten to the object being hauled.



Loop: A turn in the rope that crosses itself.



Bight: A loop that does not cross over itself, usually taken from the center of the rope.

Running End: The end of the rope not tied off and free to use.

Relative Strength of Knots
Figure 15.2

100%	No Knot
75%-80%	Figure 8
70%-80%	Bowline
65%-70%	Double Fisherman's
60%-70%	Water Knot
60%-65%	Fisherman's
60%-65%	Clove Hitch
60%-65%	Overhand Knot
60%-65%	Two Half-hitches
43%-47%	Square Knot

Patterns and Running Ends
Figure 15.4

Square Knot

"Killer" Square

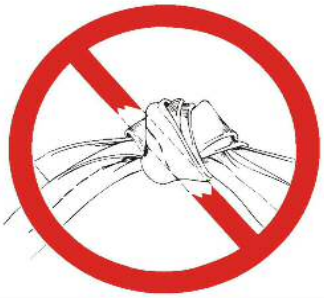
Under even a small amount of tension, the "killer" square will come undone.

Source: rbk

Setting and Dressed
Figure 15.3

As the hands pull the ends the loosely tied knot will "set" properly.

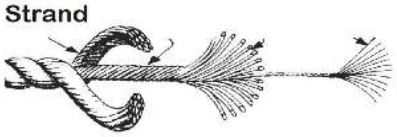
This knot is not "dressed" properly. Note the kink or unwanted twist in the webbing.



Types of Rope
Figure 15.5

Laid Rope

Strand



Strand Yarns Fibers

Solid Braid

A braided sheath is woven over the twisted-core which acts as a shock absorber.

Dynamic Kernmantle

A protective sheath is woven tightly over the load-bearing parallel-fibers in the core.

Static Kernmantle

Source: Smith, B., and Padgett, A.,(1996). ***On Rope - North American Vertical Rope Techniques***.Huntsville, AL: National Speleological Society, Inc.

Setting and Dressed (Figure 15.3) – In tying a knot, the knot is tied loosely. *Setting* is the process of tightening the knot so that it becomes dressed. A knot is *dressed* when it is configured properly. All the parts of the knot are in their proper location and the knot looks as it pictured in the textbook. This is important because, a properly dressed knot makes for easier inspection. An improperly dressed knot can lose up to 50% of its strength.

Inspection – It is important to determine that a knot is tied properly and safe. A properly dressed knot is the first consideration. A second consideration is the pattern or configuration of the knot. A figure-8 knot has a unique and distinct configuration. In a figure-8 follow-through the second rope runs parallel to the first rope within the knot. This creates a distinctive pattern. Also, it relates to the knot being properly dressed. Third, there may be a key element of the knot that needs to be checked. In the square knot, the two running ends are on the same side of the knot (Figure 15.4). In the "killer square" the running ends are on opposite sides of the knot. Except for this feature, both knots look identical. Unfortunately, the killer square knot will literally fall apart under tension.

Amount of Rope Used – Some knots consume more rope than others. With its three loops, a triple fisherman's knot consumes more rope than a double fisherman or a single fisherman. A figure eight on a bight consumes more rope than a bowline. At some point, the amount of rope consumed in tying the knot can influence its use. Not much is gained in strength of the triple fisherman over the double fisherman. However, the double fisherman does save some rope.

Types of a Rope (Figure 15.5) – Several of the common rope types are presented in Figure 15.5. These are laid, braided and kernmantle.

Kenmantle is comprised of the *kern* and the *mantle*. The mantle is a woven outer sheathing that protects the kern. Kenmantle ropes are either *dynamic* or *static*. The kern in a dynamic rope consists of twisted strands of fibers. Dynamic ropes are used in climbing and are designed to stretch. Specifically, they are designed to absorb the fall of a climber. The kern in a static rope consists of parallel unidirectional strands of fibers. The design minimizes stretch. They are not used in lead climbing or in situations designed to absorb falls.

Ropes are constructed out of nylon, spectra, and polypropylene as well as natural and other materials. Nylon is one of the more common materials. It is strong, flexible, and doesn't float in water. Spectra is much stronger than nylon which is reflected in its cost. Polypropylene has less strength than nylon. It is inexpensive and it floats in water.

Knots

When tied, a knot is self-contained and self-supporting. It doesn't need an object or another rope to maintain its integrity. This may be a fine distinction, but a distinction non-the-less. Traditionally, the term knot is used to include hitches and bend. It is used as a generic term for hitches and bends. Historically, many hitches and bends actually incorporate the term knot in their name when then are really hitches. Two families of knots are included in this section, the figure eight and bowline.

Figure Eight Family (Figure 15.6) – Consider the figure eight knot as a base knot. By itself, it is a stopper knot that is tied at the end of a rope to stop someone who is repelling from repelling off the line at the bottom of the rope. Other than this, the figure eight by itself has little utility. Other than demonstrating how to tie the knot, this author can't remember ever using the figure eight by itself. Having said this, the figure eight knot is foundational or a base knot for a whole family of knots. The figure eight on a bight, follow through, or in-line figure eight have great utility and great usage along with other derivations not noted here. These knots have been used extensively.

Figure -8* – *Figure-eight on a Bight (Figure 15.7) – The figure eight on a bight provides a loop in the end of the rope. The running end of the rope is made into a bight and the bight is tied as if were a simple figure eight. If the person is creating a loop and then clipping it (i.e. carabiner) into something else, this knot is quick and efficient. Simply, if trying to tie a loop around a person or some other fixed object, the figure eight on a bight won't work.

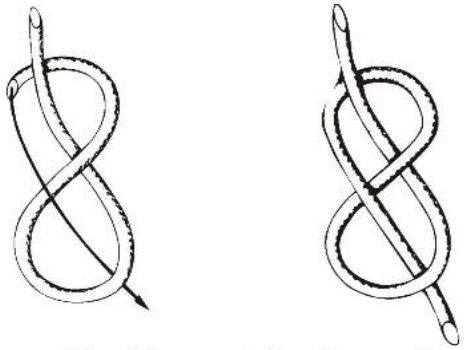
Figure-eight Follow-through (Figure 15.8) – For climbers, this is the knot used to tie into the harness. It is "bullet proof" in that it won't come undone and it provides maximum protection. It is designed to create a loop in the rope connected to the harness or around the person or other object that is secure and provides maximum protection. It is a staple of climbers. The disadvantage of this knot is that it does take time to tie. Under normal circumstances this is not a problem. In an emergency situation and when time is of the essence, this can become more problematic.

In-line Figure Eight (Figure 15.9) – The in-line figure eight is a figure eight tied onto the main line rather than as part of the main line. This enables the running end to do something else. It could be to tie a loop in the middle of the line or to create a self-equalizing anchor (see next item).

Directional Figure Eight Follow-through (Figure 15.10) – The running end of the in-line figure eight is worked back through the loop and then retraced the knot as diagramed. The setup is a self-equalizing anchor system where the pull on each anchor is the same. The system can easily incorporate multiple anchor points with the addition of another loop. If there is an abundance of carabiners, they can be used to clip the loops around the anchors to the loop at the bottom of the figure eight.

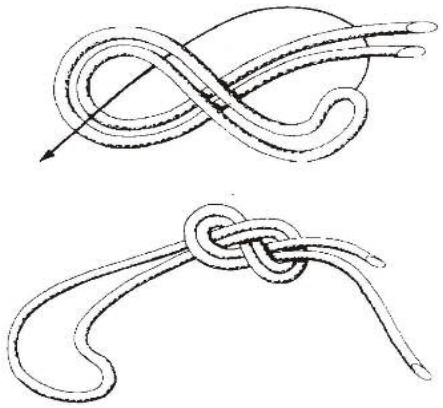
The system has been used in river rescue and to a lesser extent in climbing. The system can be hooked to multiple D-rings on a raft to extricate it from a pinning. Or it could be used to anchor a hauling line to multiple trees used as anchors where no one tree would serve as a suitable anchor. Actually, it should be used more in climbing since it is truly self-equalizing, particularly when used with carabiners.

Figure eight
Figure 15.6



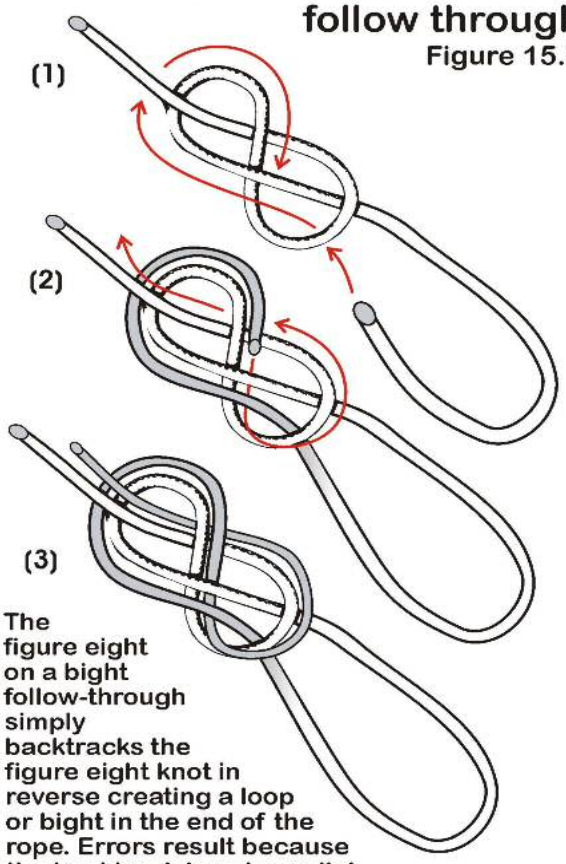
The Figure 8 knot is one of the strongest knots. It can be used as a stopper knot, to tie two ropes together, or to tie a loop in the end of a rope.

Figure eight on a bight
Figure 15.7



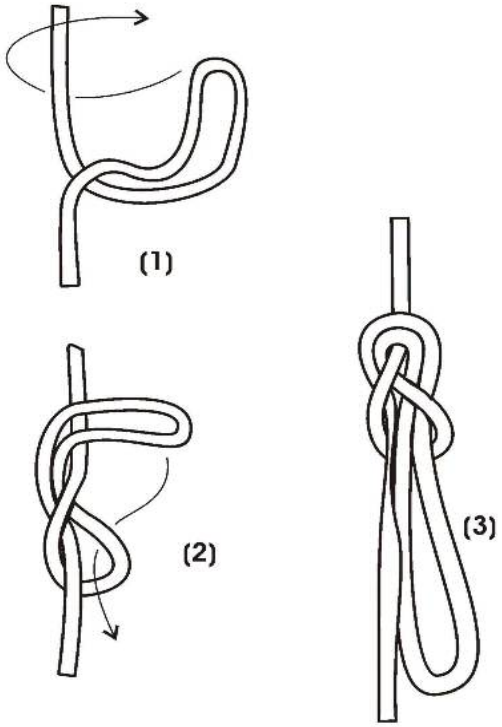
Fold the rope back on itself. Tie a Figure 8 knot with the two strands as you would the Figure 8 pictured above.

Figure eight on a bight follow through
Figure 15.8



The figure eight on a bight follow-through simply backtracks the figure eight knot in reverse creating a loop or bight in the end of the rope. Errors result because the backtrack is not parallel to the original configuration.

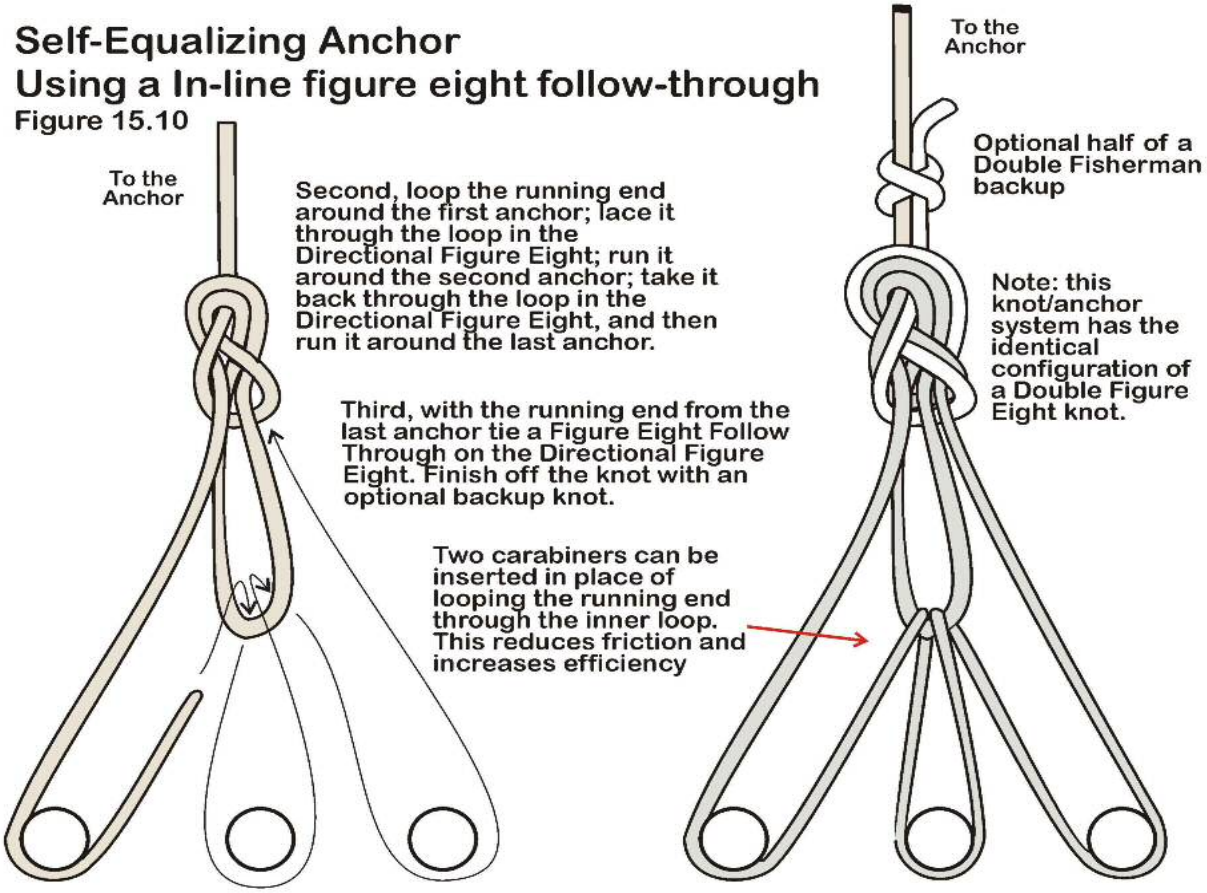
In-line figure eight
Figure 15.9



Make an overhand loop on the rope (1). Go around the back of the rope, and through the loop (2). Seat Knot (3).

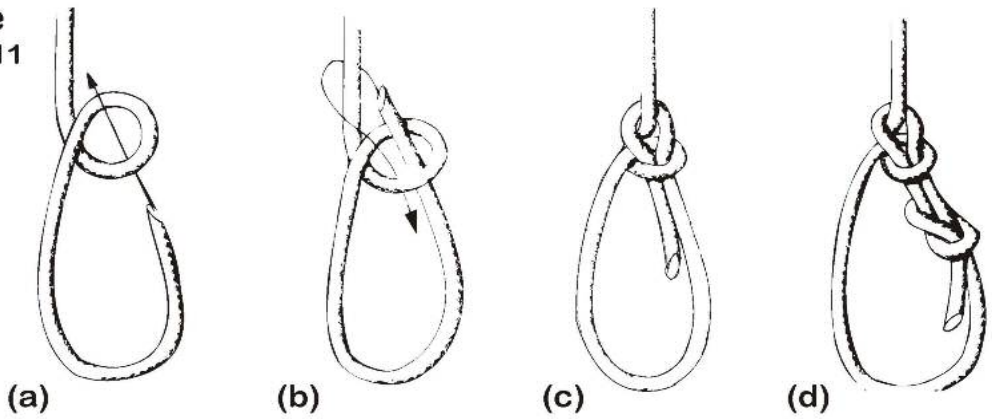
Source: Smith, B., and Padgett, A.,(1996). ***On Rope - North American Vertical Rope Techniques***,Huntsville, AL: National Speleological Society, Inc.

Self-Equalizing Anchor
Using a In-line figure eight follow-through
Figure 15.10

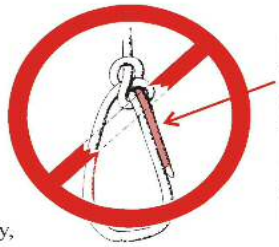


Source: Kauffman, R. (2015). ***Swiftwater Rescue Packet***. McHenry, Maryland: Garrett College. Unpublished packet.

Bowline
Figure 15.11



The rabbit comes out of his hole (a); goes around the tree and seeing the fox goes back down into his hole (b). The rabbit grabs his tail and the fox grabs the tree (don't ask me why, but you need to do so to make the knot work). They both pull (c) .... Then they both go bowling (pun intended).

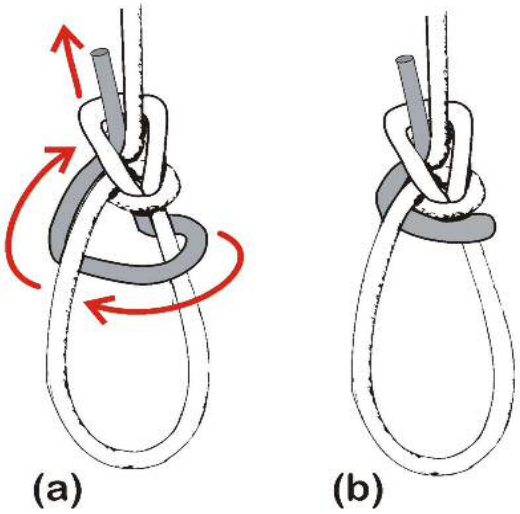


Note: Some believe the knot is weakened with the end on the outside. It is more prone to snagging and inverting into a slip knot.

Source: Smith, B., and Padgett, A.,(1996). ***On Rope - North American Vertical Rope Techniques***.Huntsville, AL: National Speleological Society,

Yosemite tie off on the bowline

Figure 15.12



The bowline tends to be a loose knot and under a tension/release situations, it can easily become loose and undone. (a) Take the running end, bring it around, through the loop, and up through the "horse collar" as shown. It is parallel to the working end. (b) Set and dress the knot. It is now backed up.

Source: Smith, B., and Padgett, A.,(1996). ***On Rope - North American Vertical Rope Techniques***.Huntsville, AL: National Speleological Society, Inc.

Bowline (Figure 15.11) – The bowline is used to tie a loop in the end of a rope. The advantage of using the bowline is that it can be tied quickly and easily. Also, it consumes less rope to tie than a figure eight follow-through. The knot maintains its integrity under tension. However, it can loosen when placed in continuous tension and compression situations. In the climbing community the bowline has fallen into disfavor for this reason. When a climber falls, they tend to bounce which can loosen the knot. If there is any doubt that the bowline could be placed in a tension and compression situation, back it up.

Yosemite Tie-off (Figure 15.12) – If there is a need for a secure bowline, back it off. The Yosemite tie-off is one of several acceptable methods. Often half of a double fisherman's knot is used. Half a single fisherman can be used in a pinch, but it tends to be a loose knot and it may fall apart under compression and tension situations which defeats its purpose as a backup.

Hitches

A hitch requires an object or another rope to maintain its integrity and structure. Several hitches are covered in this section, two half-hitches, clove hitch, Prusik, trucker's hitch, double fisherman's, tensionless anchors, and munter hitch.

Two Half-hitches (Figure 15.13) – Two half-hitches is a commonly used to tie a loop around an object or another line. It is useful in tying off the running end in a trucker's knot.

Clove Hitch (Figure 15.14) – The clove hitch is used to tie a line to a post or tent peg. The knot has the same configuration as two half-hitches. The difference is that the clove hitch fastens the running end around a fixed object (e.g. peg, posts), and two half-hitches fasten the line around another line. The clove hitch is a loose knot and in tension and compression situations, it tends to become loose and undone. This author usually backs up the clove hitch with two half-hitches to maintain its internal integrity.

Prusik (Figure 15.15) – The Prusik is a multi-purpose hitch. It is used in climbing as an ascender and in rescue on hauling systems. In many circles, it is preferred over mechanical devices because it slips at around 900 lbs of tension. This protects the system from fatiguing elsewhere. The Prusik is a hitch because without the main line to maintain its integrity, the knot will fall apart.

The Prusik is designed to cinch down on the rope and to kink the rope at an angle to increase its hold. In theory, the Prusick works best when the diameter of the Prusik is significantly smaller than the main line. In rescue work, this author has used Prusiks with diameters that are close to the main line with little adverse effect.

The first step in making a Prusik is to make a sling. Tie the two ends of the rope together using a double fisherman's knot. Next loop the Prusik around the main line and through itself as pictured in Figure 15.15.

Third, is the issue of where the double fisherman is located in the final knot. There are three options. First, the double fisherman can be positioned over the Prusick as pictured in Figure 15.15. In theory, this minimizes the loss of tensile strength due to a knot in the system and in theory, the tensile strength of the Prusik approaches that of the rope without a knot. In practice, it may not make any difference. The Prusik has two supporting lines. If the rope has a tensile strength of 900 lbs, it has an effective tensile strength of 1,800 lbs. It should be noted that some people find it easier to tie the Prusik by positioning the double fisherman over the knot.

The second option is to have the double fisherman located on the side of the sling. Practically, this approach is satisfactory. The third option is to locate the double fisherman where the carabiner fastens into the Prusik. This should be avoided since it places undue stress on the system. Often, when tying the knot, the double fisherman is grasped and looped through and around the main line. It is convenient. This approach will tend to line up the knot where the carabiner clips into the sling.

For a Prusik to be effective, it needs to be loosened easily and readjusted along the main line. This is a three-step process of loosening the knot, moving it and re-cinching it. It is important to loosen the knot first or it will be difficult to move a cinched Prusik. To loosen or untie the Prusik, pull the "horse collar" over itself. Usually, this is the double fisherman. Conceptually, this process is similar to loosening the bowline. Prusiks can easily cinch down on the main line making them difficult to move and readjust.

Trucker's (Rigger's) Hitch (Figure 15.16) – The trucker's hitch is used to fasten boats, construction materials, and other items to roof racks on a car, or to fasten lines to tent pegs that are easily adjustable. Close inspection of the rig reveals that the hitch is the same configuration as a Z-rig and offers a theoretical 3:1 mechanical advantage. This mechanical advantage makes the trucker's hitch an attractive rig for when the line needs to be taught or when the tension on the line needs to be adjusted. The adjustable lines to the tent pegs are an example of this re-adjustment. The other feature of the trucker's hitch is that it is easy to untie and when untied, the hitch simply falls apart.

In situations where the tension needs to be monitored or adjusted, or where there needs to be micro adjustments made in hauling line, the trucker's hitch is ideal for these situations. The author uses it as a staple tool to set up and adjust lines in river rescue.

Two half-hitches are used to finish off and lock the trucker's hitch into place. If there is any doubt regarding the two half-hitches, use three half-hitches. The half-hitches need to be snug or it will slide down the line. If it is anticipated that the system will be readjusted, tie the half-hitches using a bight in the rope. Pulling on the one side of the bight unties the half-hitches.

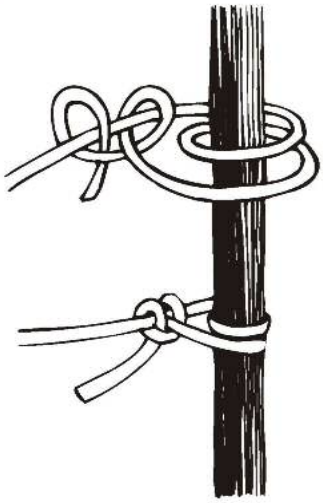
Double Fisherman (Figure 15.17) – The double fisherman is used to fasten two ends of a rope together to form a loop or sling. It is also called the grapevine knot. It is an integral component in tying the Prusik. Half of the knot is often used as a backup knot for other knots. The knot cinches on itself making it extremely difficult if virtually impossible to untie after being loaded. For this reason, it is used in situations where it won't be untied and other knots are preferred in situations where the knot is to be untied. Since it uses the other end of rope to maintain its structure, the double fisherman is a hitch.

The configuration of the single, double, and triple fisherman are essentially the same except for the number of wraps around the rope. The configuration of the single fisherman is that of an overhand knot with the other end of the rope passing through the center of the overhand knot. It tends to be a loose knot and in backup situations, half a double fisherman is generally preferred. In terms of strength, there is not much difference between it and the triple fisherman. The triple fisherman is also called the barrel knot. If consuming more rope in the knot is not an issue, the double fisherman is more than adequate.

Tensionless Anchor (Figure 15.18) – Traditionally, the tensionless anchor has been used to anchor ropes around trees. This author has used the tensionless anchor to fasten boats, construction items and other items to be hauled to the roof racks on his car. It has replaced the trucker's hitch in this use. It works by the rope creating friction around the anchor. It is a hitch because it uses the tree or roof rack to maintain its integrity and structure.

Two half-hitches

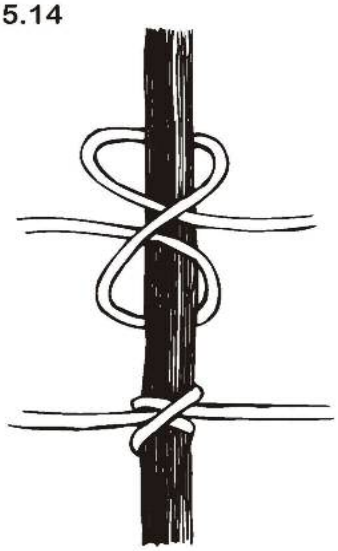
Figure 15.13



To be tied correctly, it should look like a clove hitch.

Clove hitch

Figure 15.14

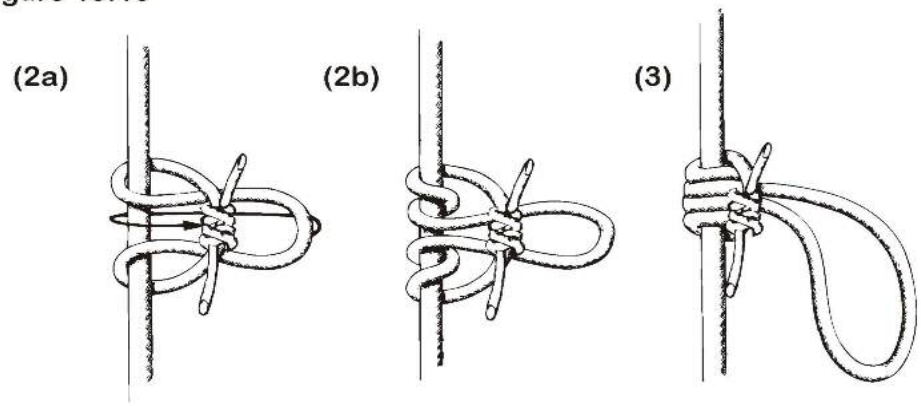


Careful inspection reveals that the clove hitch and two half-hitches are identical knot configuratons.

Usually, the author ties the clove hitch off with two half-hitches since the clove hitch tends to easily fall apart.

Prusik

Figure 15.15



1) Tie two ends of the rope using a double fisherman's knot (not shown).

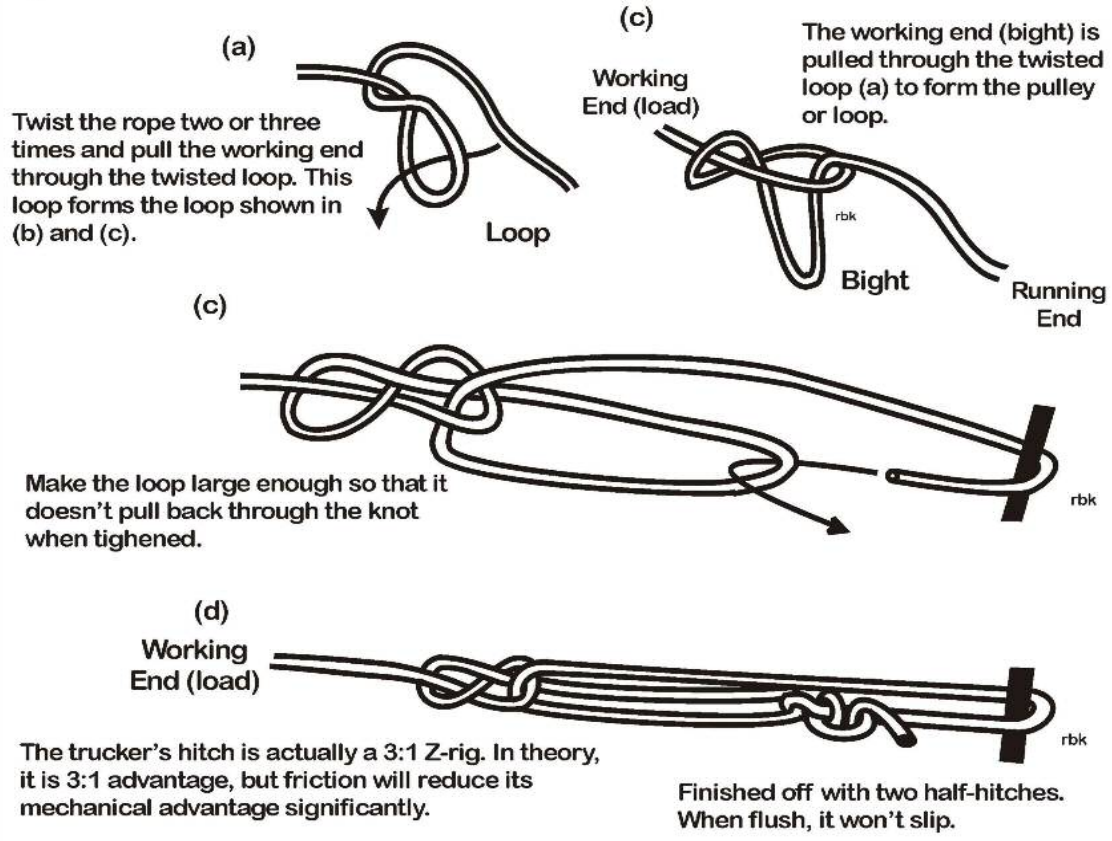
2a and 2b) Hold the double fisherman's knot in the one hand and loop two to three times around the main rope. Another loop can be added for extra bight. Make sure the loops are parallel with each other.

3) To untie a tight prusik, flip the double fisherman's knot back over the loop and push the loop through the knot. This will loosen the knot.

Source: Smith, B., and Padgett, A.,(1996). ***On Rope - North American Vertical Rope Techniques***.Huntsville, AL: National Speleological Society, Inc.

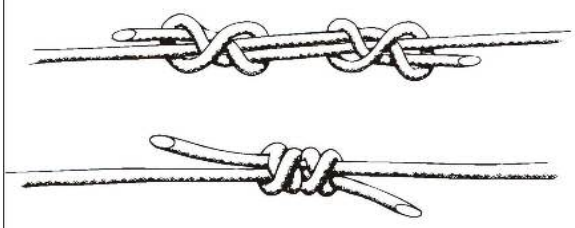
Trucker's (Rigger's) Hitch

Figure 15.16

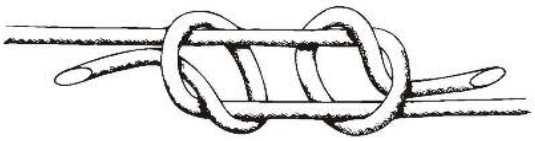


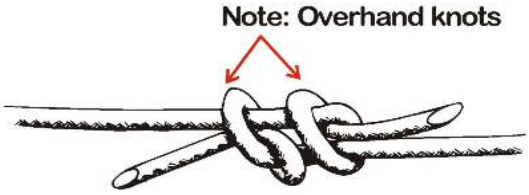
Double Fisherman's Knot

Figure 15.17



Single Fisherman's Knot





The single fisherman, double fisherman, and barrel knot belong to the same family of knots. They are really hitches. The double fisherman is the most commonly used in the group because it holds better than the single fisherman and uses less rope than a barrel knot (i.e. tripple fisherman).

The single fisherman's knot (right) shows the basic configuration of the hitch. Close inspection reveals that it is an overhand knot with the working end of the line passing through the center of the overhand knot.

Source: Smith, B., and Padgett, A.,(1996). ***On Rope - North American Vertical Rope Techniques***.Huntsville, AL: National Speleological Society, Inc.

In Figure 15.18, the tensionless anchor is drawn with the rope neatly coiled around the anchor. This need not be the case. Only the first two coils should be neatly looped around the anchor and free of crossovers. This aids when finishing off the knot. Feel free to coil the remainder of the rope around the anchor with numerous crossovers.

The literature shows several ways to finish off the tensionless anchor. The first is to let the running end hang loose (not pictured). This is not recommended. If the tensionless anchor is only under tension, it will tend to maintain its integrity and not loosen. If the system is under repeated tension and compression, it will tend to loosen and begin to fall apart.

The second method of finishing off the tensionless anchor is tie a figure eight on a bight and fasten the knot to the main line with a carabiner (not shown). This approach is slightly better than using no tie off. It does provide fail safe protection where if the system loosens and begins to unwind, it will eventually lock down on itself.

The third approach brings the loose running end around the main line on the first coil and cinching it off as shown in Figure 15.18. This is why it is important to neatly coil the first two coils. After the first two coils, the rope can be wrapped in any fashion and it can cross over itself.

The author has used this version of the tensionless anchor for years to fasten boats and other items to the roof racks on his car. It replaced the use of the trucker's hitch for tying down boats on roof racks. It is easy to tie and untie. It works equally well on metal roof racks. Also, the system tends to maintain its integrity when experiencing repeated tension and compression situations. However, if there are known situations with extreme repeated tension and compression situations, the author will normally revert to the trucker's hitch.

Munter Hitch (Figure 15.19) – The munter hitch is a friction device that can be used in place of a rappelling device. The author uses it in place of a tied off clove hitch on a carabiner.

Bends

Bends tie two ropes together. Two bends are covered, the sheetbend and water knot. A figure eight follow through is not included. However, it can easily be inferred (see Figure 15.8 and Figure 15.10). The second running end retraces the loosely tied figure eight knot in the other running end.

Sheetbend (Figure 15.20) – The sheetbend is used to tie two ropes together. Careful inspection of the knot reveals that it has the same configuration as a bowline (see figure 15.11). Hence, the sheetbend has the same attributes as a bowline. It tends to be a loose knot. Under stress and compression, it will tend to become loose and come apart. Like the bowline, it is easy to untie. Simply, break the "horse collar" and the knot falls apart. For additional strength, consider a double sheetbend with its two loops (not shown).

The alternative is a figure eight follow through (not shown). It consumes more rope in tying the knot than a sheetbend. Also, it tends to be a tighter knot in that it maintains its integrity under stress. However, a big advantage of the sheetbend over the figure eight follow through is that it can be quickly tied and quickly untied.

Tensionless Anchor
Figure 15.18

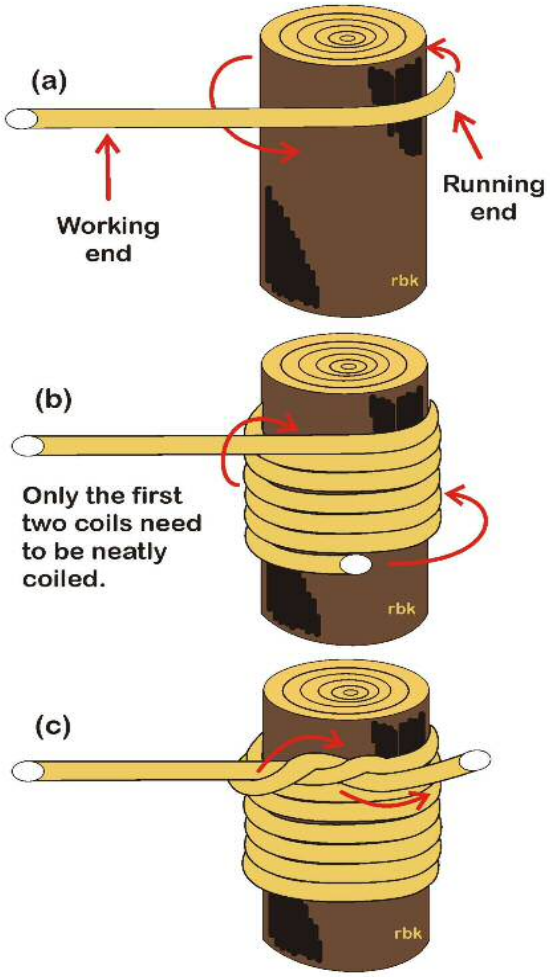
A tensionless anchor utilizes the friction created by the rope wrapped around a tree, car roof rack, or other object to prevent slippage of the standing end of the rope.

Many texts depict a tensionless anchor with the working end not tied off or just hanging (b). The problem is that the system will tend to losen and begin to unwind.

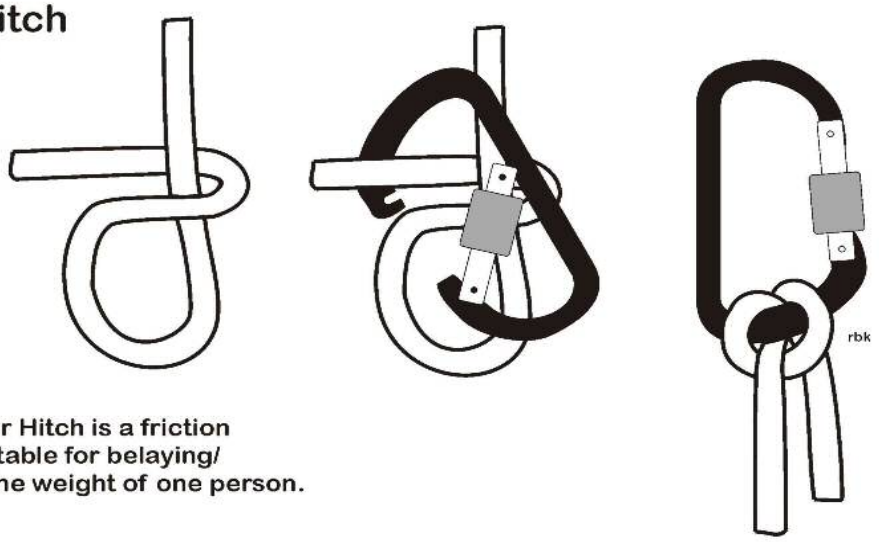
A good way to tie off the anchor is shown in (c). The working end is looped around the standing end and pulled taught. It locks the rope and maintains the integrity of the system. This author has used this system to fasten boats to a car roof rack for years. It is quick and easy to tie and untie.

Some people will tie the working end to the standing end using two half-hitches (not shown). It works, but in the estimation of this author, it is not as efficient as (c).

The diagrams show the rope neatly coiled around the tree, roof rack, etc. Only the first two loops should be neatly coiled. The remaining coils can be wrapped crossing over each other without ill effect.



Munter Hitch
Figure 15.19



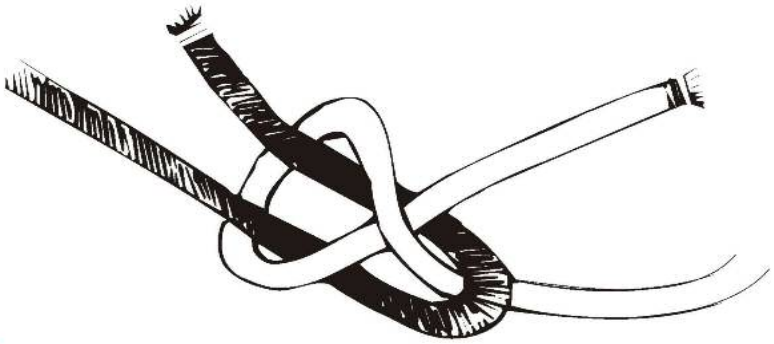
The Munter Hitch is a friction device suitable for belaying/ lowering the weight of one person.

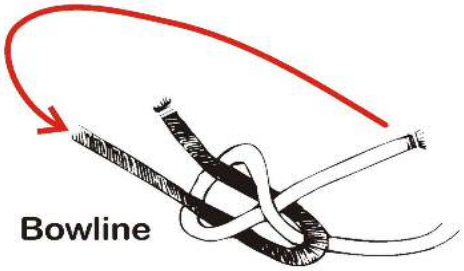
Source: Kauffman, R. (2015). ***Swiftwater Rescue Packet***. McHenry, Maryland: Garrett College. Unpublished packet.

Sheetbend

Figure 15.20

Use the sheetbend for tying two ropes together even if they are of different diameters. A double sheetbend (not shown) is better.



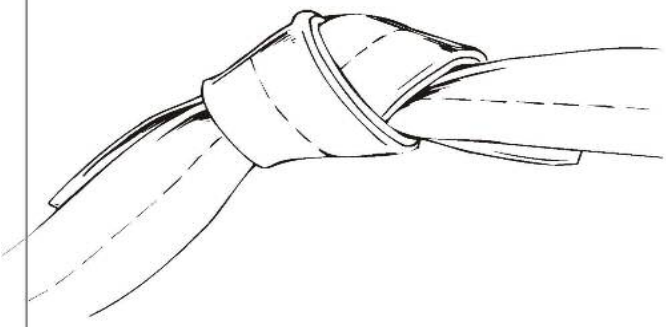


Bowline

Careful inspection reveals that the sheetbend has the same configuration as a bowline.

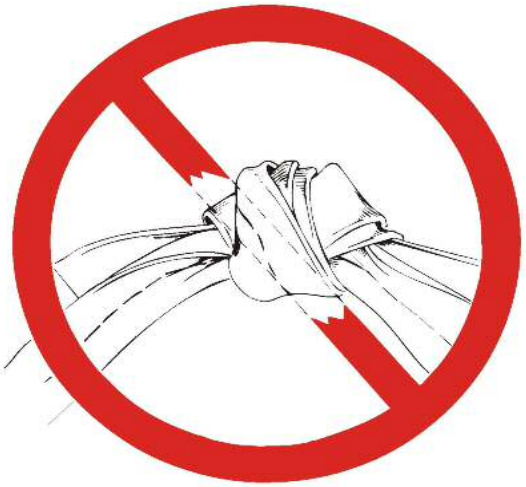
Water Knot (Bend)

Figure 15.21



ABOVE: The water knot is a follow-through overhand knot. It is the preferred knot for tying two pieces of webbing together. Tie an overhand knot in the one piece of webbing. With the other piece of webbing, trace it back through the original overhand knot following every bend. It creates a parallel knot that mirrors the original knot.

BELOW: This knot is not "seated" properly. There is a kink or unwanted twist in the webbing.



Source: Smith, B., and Padgett, A.,(1996). ***On Rope - North American Vertical Rope Techniques***.Huntsville, AL: National Speleological Society, Inc.

Water Knot (Figure 15.21) – The water knot is used to tie two pieces of webbing together to form a sling. This is the primary purpose of the knot and no other knot excels like the water knot in this capacity. Normally, it is not used to tie two ropes together. A sheetbend or figure eight follow through would be used. The configuration of the knot is that of an overhand knot.

The knot is tied as an overhand knot follow-through. Tie an overhand knot loosely in the webbing. With the other end, follow through the knot in reverse. Seat and dress the knot. Avoid kinks. The follow through webbing should parallel the original knot. No backup is needed. The knot maintains its tightness under stress and compression and remains tight.

Summary

Technically, knots, hitches and bends are structurally different. Regardless, the term knot is used generically to cover knots, hitches, and bends. It was done so here. In addition, the three types of knots indicate three basic knot tying situations. The rope is fasten to another object (i.e. hitch). It is fasten to another rope (i.e. bend). Or it is a self-supporting knot in the rope that creates a loop or serves some other function.

Consider knowing how to tie one knot in each of these three situations. The corollary is that sometimes less is more. Consider being able to tie these three knots blindfolded, backwards, or forwards. The point is that knowing how to tie a few knots well is better than trying to tie multiple knots with overlapping functions.

References

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Lawrence, J., Uhl, H., Dodds, A., and Sullivan, M., (1993) *Universal Study Guide for Cave Rescue Training*. Huntsville, Alabama: National Speleological Society.

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