Even the most carefully planned project can run into trouble. No matter how well you plan, your project can always run into unexpected problems. Team members get sick or quit, resources that you were depending on turn out to be unavailable—even the weather can throw you for a loop. So does that mean that you’re helpless against unknown problems? No! You can use risk planning to identify potential problems that could cause trouble for your project, analyze how likely they’ll be to occur, take action to prevent the risks you can avoid, and minimize the ones that you can’t.
What's a risk?

There are no guarantees on any project! Even the simplest activity can run into unexpected problems. Any time there's anything that *might* occur on your project and change the outcome of a project activity, we call that a risk. A risk can be an event (like a fire), or it can be a condition (like an important part being unavailable). Either way, it's something that may or may not happen... but if it does, then it will force you to change the way you and your team will work on the project.

A risk is any uncertain event or condition that might affect your project. Not all risks are negative.

Some events (like finding an easier way to do an activity) or conditions (like lower prices for certain materials) can help your project! When this happens, we call it an opportunity... but it's still handled just like a risk.
How you deal with risk

When you’re planning your project, risks are still uncertain: they haven’t happened yet. But eventually, some of the risks that you plan for do happen. And that’s when you have to deal with them. There are four basic ways to handle a risk:

1. Avoid
   The best thing that you can do with a risk is avoid it—if you can prevent it from happening, it definitely won’t hurt your project.

2. Mitigate
   If you can’t avoid the risk, you can mitigate it. This means taking some sort of action that will cause it to do as little damage to your project as possible.

3. Transfer
   One effective way to deal with a risk is to pay someone else to accept it for you. The most common way to do this is to buy insurance.

4. Accept
   When you can’t avoid, mitigate, or transfer a risk, then you have to accept it. But even when you accept a risk, at least you’ve looked at the alternatives and you know what will happen if it occurs.

The easiest way to avoid this risk is to walk away from the cliff... but that may not be an option on this project.

Looks like falling is the best option.
Risk Management Planning

By now, you should have a pretty good feel for how each of the planning processes work. The past few knowledge areas started out with their own planning process, and Risk Management is no different. You start with the Risk Management Planning process, which should look very familiar to you.

You’ll need to see if there are standard templates, roles and responsibilities, or risk categories that your company uses.

By the time a risk actually occurs on your project, it’s too late to do anything about it. That’s why you need to plan for risks from the beginning and keep coming back to do more planning throughout the project.

Are people at your company risk takers? Do they play it safe? Every company has people with different attitudes about risk.

Are you starting to see a pattern here?

You may get a question on the exam that asks which processes use Organizational Process Assets! Think about why you need them for Risk Management Planning and the other planning processes. That should help you remember which processes need ‘em.
The Risk Management Plan is the only output

It tells you how you’re going to handle risk on your project—which you probably guessed, since that’s what management plans do. It says how you’ll assess risk on the project, who’s responsible for doing it, and how often you’ll do risk planning (since you’ll have to meet about risk planning with your team throughout the project).

The plan has parts that are really useful for managing risk:

- It has a bunch of categories that you’ll use to classify your risks. Some risks are technical, like a component that might turn out to be difficult to use. Others are external, like changes in the market or even problems with the weather.

- You might find a Risk Breakdown Structure (RBS) here. It’s a great tool for managing your risk categories. It looks like a WBS, except instead of tasks it shows how the risks break down into categories.

- It’s important to come up with guidelines to help you figure out how big a risk’s impact is. The impact tells you how much damage the risk will cause to your project. A lot of projects classify impact on a scale from minimal to severe, or from very low to very high.

- The plan should also give you a scale to help figure out the probability of the risk. Some risks are very likely; others aren’t.
Use a risk breakdown structure to categorize risks

You should build guidelines for risk categories into your risk management plan, and the easiest way to do that is to use a risk breakdown structure (RBS). Notice how it looks a lot like a WBS? It's a similar idea—you come up with major risk categories, and then decompose them into more detailed ones.

The RBS is just one way to categorize risks. It's not a tool or technique by itself; you'll include it as part of the Risk Management Plan.

Once you come up with a list of risks, you'll label each one of them with one of these categories. That will make it easier to figure out how to deal with the risks later.
Sharpen your pencil

Take a look at how each of these project risks is handled and figure out if the risk is being avoided, mitigated, transferred, or accepted.

1. Stormy weather and high winds could cause very slippery conditions, so you put up a tent and wear slip-resistant footwear to keep from losing your footing.

☐ Avoided ☐ Mitigated
☐ Transferred ☐ Accepted

2. You buy a surge protector to make sure a lightning strike won’t blow out all of your equipment.

☐ Avoided ☐ Mitigated
☐ Transferred ☐ Accepted

3. Flooding could cause serious damage to your equipment, so you buy an insurance policy that covers flood damage.

☐ Avoided ☐ Mitigated
☐ Transferred ☐ Accepted

4. The manufacturer issues a warning that the safety equipment you are using has a small but nonzero probability of failure under the conditions that you’ll be facing. You replace it with more appropriate equipment.

☐ Avoided ☐ Mitigated
☐ Transferred ☐ Accepted

5. A mud slide would be very damaging to your project, but there’s nothing you can do about it.

☐ Avoided ☐ Mitigated
☐ Transferred ☐ Accepted

6. A team member discovers that the location you planned on using is in a county that is considering regulations that could be expensive to comply with. You work with a surveying team to find a new location.

☐ Avoided ☐ Mitigated
☐ Transferred ☐ Accepted

7. Surrounding geological features could interfere with your communications equipment, so you bring a flare gun and rescue beacon in case it fails.

☐ Avoided ☐ Mitigated
☐ Transferred ☐ Accepted

Answers: 1 - mitigated  2 - mitigated  3 - transferred  4 - avoided  5 - accepted  6 - avoided  7 - mitigated
Anatomy of a Risk

Once you’re done with Risk Planning, there are four more risk management processes that will help you and your team come up with the list of risks for your project, analyze how they could affect your project, and plan how you and your team will respond if any of the risks materialize when you’re executing the project.

Risk Identification

The first thing you need to do when planning for risks is to gather the team together and come up with a list of every possible risk you can think of.

The RBS you created during Risk Management Planning will make it a lot easier to do this.

Qualitative Risk Analysis

Once you’ve got a list of risks, you’ll need to get a good idea of the probability and impact of each risk.

Remember the probability and impact guidelines in the risk management plan? This is where you use them to assign a probability and impact to each risk!
By the time you get here, you’ve got a list of risks, with a probability and impact assigned to each risk. That’s a great starting point, but sometimes you need more information if you want to make good decisions...

All four of these Risk Management processes are in the Planning process group—you need to plan for your project’s risks before you start executing the project.

All that’s left now is to plan responses to each risk! This is where you decide whether to avoid, mitigate, transfer, or accept... and how you’ll do it!

Quantitative Risk Analysis

...You can make better decisions with more precise information. That’s what this process is about—assigning numerical values for the probability and impact of each risk.

Risk Response Planning

Why do you need to do qualitative risk analysis first and quantitative risk analysis second?
What could happen to your project?

You can’t plan for risks until you’ve figured out which ones you’re likely to run into. That’s why the first risk management process is **Risk Identification**. The idea is that you want to figure out every possible risk that might affect your project. Don’t worry about how unlikely the risk is, or how bad the impact would be—you’ll figure that stuff out later.

Remember the assumptions you put in here? Those are all risks—if you assume something that’s not true, it will change the project.

You should look at lessons learned from past projects to see what went wrong.

The tools and techniques—especially **Risk Identification**—are all about gathering information from people and making sure it’s right.

The goal of all of the risk planning processes is to produce the risk register. That’s your main weapon against risk.

The risk register is the only output—and it’s the most important part of risk management. It’s a list of all of the risks and some initial ideas about how you’d respond to them.

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Information gathering techniques for Risk Identification

You probably already guessed that the goal of risk identification is to identify risks—seems pretty obvious, right? And the most important way to identify those risks is to gather information from the team. That’s why the first—and most important—technique in Risk Identification is called **Information Gathering Techniques**. These are time-tested and effective ways to get information from your team, stakeholders, and anyone else that might have information on risks.

**Brainstorming** is the first thing you should do with your team. Get them all together in a room, and start pumping out ideas. Brainstorming sessions always have a **facilitator** to lead the team and help turn their ideas into a list of risks.

**The Delphi technique** is a way to get opinions and ideas from experts. This is another technique that uses a facilitator, but instead of gathering team members in a room, they send questionnaires to experts asking about important project risks. They take those answers and circulates them all to the experts—but each expert is kept **anonymous** so that they can give honest feedback.

**Interviews** are a really important part of identifying risk. Try to find everyone who might have an opinion and ask them about what could cause trouble on the project. The sponsor or client will think about the project in a very different way than the project team.

**SWOT analysis** lets you analyze strengths, weaknesses, opportunities, and threats.

**Root cause identification** is analyzing each risk and figuring out what’s actually behind it. Even though falling off of the cliff and having your tent blow away are two separate risks, when you take a closer look you might find that they’re both caused by the **same thing**: high winds, which is the root cause for both of them. So you know that if you get high winds, you need to be on the lookout for both risks!

What’s the big difference between Brainstorming and the Delphi Technique? Can you think of a situation where one would be more useful than the other?
More risk identification techniques

Even though gathering information is the biggest part of risk identification, it’s not the only part of it. There are other tools and techniques that you’ll use to make sure that the risk register you put together has as many risks as possible. The more you know about risk going into the project, the better you’ll handle surprises when they happen. And that’s what these tools and techniques are for—looking far and wide to get every risk possible.

Documentation reviews are when you look at plans, requirements, documents from your organizational process assets, and any other relevant documents that you can find to squeeze every possible risk out of them.

Assumptions analysis is what you’re doing when you look over your project’s assumptions. Remember how important assumptions were when you were estimating the project? Well, now it’s time to look back at the assumptions you made and make sure that they really are things you can assume about the project. Wrong assumptions are definitely a risk.

Checklist analysis means using checklists that you developed specifically to help you find risks. Your checklist might remind you to check certain assumptions, talk to certain people, or review documents you might have overlooked.

Diagramming techniques should be pretty familiar to you already. You can use the Ishikawa or Fishbone diagrams from Quality Management to help you find the root cause of a risk, just like you did for a defect. You can also use flowcharts to see how parts of your system interact—any place where they get complex or uncertain is a good source of risks.

The team made assumptions during planning to deal with incomplete information... and there’s a risk that each assumption could turn out to be wrong.
Read each of these scenarios and identify which tool or technique is being used. If a scenario uses an information gathering technique, specify which one.

1. Your project requires that you set up a campsite on the edge of a cliff. You gather your team members, including a geologist, a meteorologist, a tracker, and three campsite workers, and lead them in a directed discussion where they identify as many risks as possible.

2. You look through your company’s asset library and discover that two previous projects involved setting up camp in this area. You look through the lessons learned to figure out what went wrong, and what could have been avoided through better planning.

3. You’ve sent a questionnaire to a park ranger and engineers at tent and hiking equipment companies to gather their opinions on the risk of falling off of a cliff. You remove their names from their responses, copy them, and send them back to everyone to get their feedback.

4. You’ve identified a risk that is very complex, so you identify the root cause. You use the Ishikawa technique to gain insight into it.

5. You’ve reviewed your estimates and find that you had assumed that seasonal weather patterns would hold. If they change, then it could cause serious problems with the project.

6. You meet individually with many different people: the sponsor, stakeholders, team members, and experts. You ask each of them detailed questions about what they think could go wrong on the project.
Where to look for risks

A good way to understand risks for the exam is to know where they come from. If you start thinking about how you find risks on your project, it will help you figure out how to handle them.

Here are a few things to keep in mind when you’re looking for risks:

1. You can’t always depend on all the resources you were promised.
   Have you ever been promised a person, equipment, conference room, or some other resource, only to be told at the last minute that the resource you were depending on wasn’t available? What about having a critical team member get sick or leave the company at the worst possible time? Check your list of resources. If a resource might not be available to you when you need it, then that’s a risk.

2. The critical path is full of risks.
   Remember the critical path method from the Time Management chapter? Well, an activity on the critical path is a lot riskier than an activity with plenty of float, because any delay in that activity will delay the project.

3. “When you assume…”
   Have you ever heard that old saying about what happens when you assume? At the beginning of the project, your team had to make a bunch of assumptions in order to do your estimates. But some of those assumptions may not actually be true, even though you needed to make them for the sake of the estimate. It’s a good thing you wrote them down—now it’s time to go back and look at that list. If you find that some of them that are likely to be false, then you’ve found a risk.

4. Look outside your project.
   Is there a new rule, regulation or law being passed that might affect your project? A new union contract being negotiated? Could the price of a critical component suddenly jump? There are plenty of things outside of your project that are risks—and if you identify them now, you can plan for them and not be caught off guard.

These areas are a good start, but there are plenty of other places on your project where you can find risks. Can you think of some of them?
Now put it in the risk register

The point of the Risk Identification process is to... well, identify risks. But what does that really give you? You need to know enough about each risk to analyze it and make good decisions about how to handle it. So when you’re doing interviews, leading brainstorming sessions, analyzing assumptions, gathering expert opinions with the Delphi technique, and using the other Risk Identification tools and techniques, you’re gathering exactly the things you need to add to the risk register.

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The Risk Register is built into the Risk Management Plan. It’s the only output of the Risk Identification process.
Rank your risks

It’s not enough to know that risks are out there. You can identify risks all day long, and there’s really no limit to the number of risks you can think of. But some of them are likely to occur, while others are very improbable. It’s the ones that have much better odds of happening that you really want to plan for.

Besides, some risks will cause a whole lot of damage to your project if they happen, while others will barely make a scratch… and you care much more about the risks that will have a big impact. That’s why you need the next risk management process, **Qualitative Risk Analysis**—so you can look at each risk and figure out how likely it is and how big its impact will be.

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<tbody>
<tr>
<td>High winds can need to use shelter</td>
<td>Reinforce tent poles, claim waiting area equipment</td>
<td>Abnormal weather service provided, flaw in canopy design</td>
</tr>
<tr>
<td>Risk rental is available</td>
<td>Pay to reserve equipment at a second company</td>
<td>Equipment not reserved for event</td>
</tr>
<tr>
<td>Equipment leaves a large target</td>
<td>No spectators were hard by the event</td>
<td>Event itinerary report said higher-than-normal injury rate for rental equipment</td>
</tr>
</tbody>
</table>

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Why do you think Enterprise Environmental Factors are NOT an input to the Qualitative Risk Analysis process?
Examine each risk in the register

Not all risks are created equal. Some of them are really likely to happen, while others are almost impossible. One risk will cause a catastrophe on your project if it happens; another will just waste a few minutes of someone’s time.

Risk data quality assessment means making sure that the information you’re using in your risk assessment is accurate. Sometimes it makes sense to bring in outside experts to check out the validity of your risk assessment data. Sometimes you can even confirm the quality of the data on your own, by checking some sample of it against other data sources.

Risk urgency assessment is checking out how soon you’re going to need to take care of a particular risk. If a risk is going to happen soon, you’d better have a plan for how to deal with it soon, too.

Risk probability and impact assessment
One of the best ways to be sure that you’re handling your risks properly is to examine how likely they are to happen, and how bad (or good) it will be if they do. This process helps you assign a probability to the likelihood of a risk occurring, and then figure out the actual cost (or impact) if it does happen. You can use these values to figure out which of your risks need a pretty solid mitigation plan, and which can be monitored as the project goes on.

Risk categorization is all about grouping your risks so that you can come up with a better strategy for dealing with them. You might group them by the phase of the project where you’ll see them or by the source of the risk. Or you could come up with a bunch of additional categories that would help you to organize your response better and be ready for the risk if it should happen.

Creating risk categories can help you deal with whole groups of risks in one response plan.

Qualitative Risk Analysis helps you prioritize each risk and figure out its probability and impact.

Sometimes you’ll find that some risks have obviously low probability and impact, so you won’t put them in your register. Instead, you can add them to a watchlist, which is just a list of risks, like those you don’t want to forget about, but you don’t need to track as closely. You’ll check your watchlist from time to time to keep an eye on things.

Probability and impact matrix is a table where all of your risks are plotted out according to the values you assign. It’s a good way of looking at the data so you can more easily make judgments about which risks require response. The ones with the higher numbers are more likely to happen and will have a bigger impact on your project if they do. So you’d better figure out how to handle those.

<table>
<thead>
<tr>
<th>Probability</th>
<th>P&amp;I</th>
</tr>
</thead>
<tbody>
<tr>
<td>.9</td>
<td>.09 .27 .45 .63 .89</td>
</tr>
<tr>
<td>.7</td>
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</tr>
<tr>
<td>.1</td>
<td>.01 .03 .05 .07 .09</td>
</tr>
<tr>
<td>Impact</td>
<td>.1 .3 .5 .7 .9</td>
</tr>
</tbody>
</table>
Here are some facts about the cliff project that were uncovered during qualitative analysis. Update the risk register on the facing page with the appropriate information.

<table>
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<tr>
<th>Risk</th>
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</tr>
</thead>
<tbody>
<tr>
<td>1. Landslide</td>
<td>.1</td>
<td>.9</td>
</tr>
<tr>
<td>2. Winds</td>
<td>.7</td>
<td>.9</td>
</tr>
<tr>
<td>3. No truck</td>
<td>.3</td>
<td>.7</td>
</tr>
<tr>
<td>4. Storms</td>
<td>.5</td>
<td>.3</td>
</tr>
<tr>
<td>5. Supplies</td>
<td>.1</td>
<td>.5</td>
</tr>
<tr>
<td>6. Illness</td>
<td>.1</td>
<td>.7</td>
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**Prob. & Impact Matrix**

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</table>

This gives you a good picture of the threshold the company has set for evaluating risks.

1. The organizational process assets at your company set a high-priority risk as any risk with a Probability and Impact score higher than 0.20. Medium-priority risks are those between 0.10 and 0.19, and low-priority are those between 0–0.09. Low-priority risks can be monitored on a watchlist, but High and Medium ones must have a response strategy.

**Fill in the missing values in the Priority and Probability columns in the risk register on the right, using the Probability and Impact matrix to figure out which ones are low, medium or high.**

For example, we filled in “High” under Priority for row #3 by looking up risk (“No truck”) in the first table, finding the probability and impact values, and then using the Probability & Impact Matrix. The probability is .3 and the impact is .7, so you can find the corresponding box in the matrix. Since it’s dark gray, its priority is “High.”

2. After analyzing your data, you came up with three risk categories for the project: natural, equipment, and human. **Fill in the missing values in the “Category” column of the risk register with either “Natural,” “Equipment,” or “Human.”** We started you out by filling in a few of them.

3. For this particular project, you’ll need the equipment at the start of the project, so any equipment risks are considered high urgency. Natural and human risks are all medium urgency, except for ones that have to do with storms, which you consider low urgency for this project because of limited mitigation potential.

**Figure out the whether the urgency for each risk is “Low,” “Medium,” or “High” and fill in the “Urgency” column in the risk register.**
### Identified Risks

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<td>Equipment</td>
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<td></td>
</tr>
<tr>
<td>4. Storms predicted through the first two weeks of project schedule time</td>
<td>Create reserves to account for time lost due to storms</td>
<td>El Niño weather pattern</td>
<td></td>
<td>Medium</td>
<td>Low</td>
</tr>
<tr>
<td>5. Supply shortage if we don’t accurately predict food needs</td>
<td>Nearest store is 30 miles away</td>
<td></td>
<td>Equipment</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. If someone gets sick, it could be a problem getting medical care</td>
<td>Bring a doctor with us on the project</td>
<td>Nearest hospital is 50 miles away</td>
<td></td>
<td></td>
<td></td>
</tr>
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It's okay for some responses to be blank—you'll fill them in later during the Risk Response Planning process.
Qualitative analysis helps you figure out which risks are most important to your project’s success. When you’ve finished your analysis, you should have a risk register that tells you a lot more about what could go wrong.

The only output of qualitative risk analysis is the updated risk register.

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<td>5. Supply shortage if we don’t accurately predict food needs</td>
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<td>6. If someone gets sick it could be a problem getting medical care</td>
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<td>Nearest hospital is 50 miles away</td>
<td>Human</td>
<td>Low</td>
<td>Medium</td>
</tr>
</tbody>
</table>
Q: Who does qualitative risk analysis?
A: The whole team needs to work on it together. The more of your team members who are helping to think of possible risks, the better off your plan will be. Everybody can work together to think of different risks to their particular part of the work, and that should give an accurate picture of what could happen on the project.

Q: What if people disagree on how to rank risks?
A: There are a lot of ways to think about risks. If a risk has a large impact on your part of the project or your goals, you can bet that it will seem more important to you than the stuff that affects other people in the group. The best way to keep the right perspective is to keep everybody on the team evaluating risks based on how they affect the overall project goals. If everyone focuses on the effect each risk will have on the cost, quality, and scope of your project, risks will get ranked in the order that is best for everybody.

Q: Where do the categories come from?
A: You can create categories however you want. Usually, people categorize risks in ways that help them come up with response strategies. Some people use project phase. That way, they can come up with a risk mitigation plan for each phase of a project, and they can cut down on the information they need to manage throughout. Some people like to use the source of the risk as a category. If you do that, you can find mitigation plans that can help you deal with each source separately. That might come in handy if you are dealing with a bunch of different contractors or suppliers and you want to manage the risks associated with each separately.

Q: How do I know if I’ve got all the risks?
A: Unfortunately, you never know the answer to that one. That’s why it’s important to keep monitoring your risk register throughout the project. It’s important that you are constantly updating it and that you never let it sit and collect dust. You should be looking for risks throughout all phases of your project, not just when you’re starting out.

Q: I’m still not clear on the difference between Delphi and brainstorming.
A: It’s easy to get those two confused because both are about people sitting and thinking of risks. Delphi is a technique where you ask experts to give their opinion anonymously, and then you evaluate those opinions. Brainstorming is just you and your team sitting in a room thinking of risks.

Q: What’s the point in even tracking low-priority risks? Why have a watchlist at all?
A: Actually, watchlists are just a list of all of the risks that you want to monitor as the project goes on. You might be watching them to see if conditions change and make them more likely to happen. By keeping a watchlist, you make sure that all of the risks that seem low priority when you are doing your analysis get caught before they cause serious damage if they become more likely later in the project.

The conditions that cause a risk are called triggers. So, say you have a plan set up to deal with storms, and you know that you might track a trigger for lightning damage, such as a thunderstorm. If there’s no thunderstorm, it’s really unlikely that you will see lightning damage, but once the storm has started, the chance for the risk to occur skyrockets.

Q: I still don’t get the difference between priority and urgency.
A: Priority tells you how important a risk is, while urgency tells you when you need to deal with it. Some risks could be high priority but low urgency, which means that they’re really important, but not time-critical. For example, you might know that a certain supplier that provides critical equipment will go out of business in six months, and you absolutely need to find a new supplier. But you have six months to do it. Finding a new supplier is a high priority, because your project will fail if it’s not taken care of. But it’s not urgent—even if it takes you four months to find a new supplier, nothing bad will happen.
Qualitative vs. quantitative analysis

Let’s say you’re a fitness trainer, and your specialty is helping millionaires get ready for major endurance trials. You get paid the same for each job, but the catch is that you only get paid if they succeed. Which of these clients would you take on?

Running a Marathon vs. Climbing Mount Everest

One client wants you to help him train so that he can finish a marathon. He doesn’t have to win, just get to the finish line.

Another client wants you to help him get to the top of Mount Everest. He won’t be satisfied unless he gets to the summit.

It’s much more likely that you can get even an out-of-shape millionaire to finish a marathon than it is that you can get him to climb Mount Everest successfully.

In fact, since the 1950s, 10,000 people have attempted to climb Mount Everest, and only 1,200 have succeeded. 200 have died. Your qualitative analysis probably told you that the climbing project would be the riskier of the two. But having the numbers to back up that judgment is what quantitative analysis is all about.
Quantitative risk analysis

Once you’ve identified risks and ranked them according to the team’s assessment, you need to take your analysis a little further and make sure that the numbers back you up. Sometimes you’ll find that your initial assessment needs to be updated when you look into it further.

The tools for this process are all about gathering data and analyzing it to determine probability of risks occurring.

Once you’re done analyzing, you update the risk register with the data you’ve gathered.

The risk register from qualitative analysis is an input to quantitative analysis.

The PM Plan and the Risk Plan describe how you’ll analyze risk.

Once you've identified risks and ranked them according to the team’s assessment, you need to take your analysis a little further and make sure that the numbers back you up. Sometimes you’ll find that your initial assessment needs to be updated when you look into it further.

The tools for this process are all about gathering data and analyzing it to determine probability of risks occurring.

Once you’re done analyzing, you update the risk register with the data you’ve gathered.
First gather the data...

Quantitative tools are broken down into two categories: the ones that help you get more information about risks and the ones that help you to analyze the information you have. The tools for gathering data focus on gathering numbers about the risks you have already identified and ranked.

Interviewing
Sometimes the best way to get hard data about your risks is to interview people who understand them. In a risk interview, you might focus on getting three-point cost estimates so that you can come up with a budget range that will help you mitigate risks later. Another good reason to interview is to establish ranges of probability and impact, and document the reasons for the estimates on both sides of the range.

Probability distribution
Sometimes taking a look at your time and cost estimate ranges in terms of their distribution will help you generate more data about them. You probably remember these distribution curves from your probability and statistics classes in school. Don’t worry, you won’t be asked to remember the formal definition of probability distributions or even to be able to create them. You just need to know that they are another way of gathering data for quantitative analysis.

Expert judgment
It’s always a good idea to contact the experts if you have access to them. People who have a good handle on statistics or risk analysis in general are always helpful when you are doing quantitative analysis. Also, it’s great to hear from anybody who has a lot of experience with the kind of project you are creating, too.
... then analyze it

Now that you have all the data you can get about your risk register, it’s time to analyze that information. Most of the tools for analyzing risk data are about figuring out how much the risk will end up costing you.

**Sensitivity analysis** is all about looking at the effect one variable might have if you could completely isolate it. You might look at the cost of a windstorm on human safety, equipment loss, and tent stability without taking into account other issues that might accompany the windstorm (like rain damage or possible debris from nearby campsites). People generally use tornado diagrams to look at a project’s sensitivity to just one risk factor.

**Expected monetary value analysis** lets you examine costs of all of the paths you might take through the project depending on which risks occur and assign a monetary value to each decision. So, if it costs $100 to survey the cliff and $20 to stake your tent, choosing to stake your tent after you’ve looked at the cliff has an expected monetary value of $120.

The main method of Expected Monetary value analysis you need to know for the test is **Decision Tree Analysis**. For decision tree analysis, you just diagram out all of the decisions you think you will need to make to deal with risks. Then you add up all that you would need to spend to make each decision.

**Modeling and distribution.** It’s also a good idea to run your project risks through modeling programs if you can. Monte Carlo analysis is one such tool that can randomize the outcomes of your risks and the probabilities of them occurring to help you get a better sense of how to handle the risks you have identified.
Calculate the Expected Monetary Value of your risks

Okay, so you know the probability and impact of each risk. How does that really help you plan? Well, it turns out that if you have good numbers for those things, you can actually figure out how much those risks are going to cost your project. You can do that by calculating the Expected Monetary Value (or EMV) of each risk:

1. Start with the probability and impact of each risk.

<table>
<thead>
<tr>
<th>Risk</th>
<th>Probability</th>
<th>Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>High winds</td>
<td>35%</td>
<td>cost $48 to replace equipment</td>
</tr>
<tr>
<td>Mudslide</td>
<td>5%</td>
<td>lose $750 in damage costs</td>
</tr>
<tr>
<td>Wind generator usable</td>
<td>15%</td>
<td>save $800 in battery costs</td>
</tr>
<tr>
<td>Truck rental unavailable</td>
<td>10%</td>
<td>cost $350 for last-minute rental</td>
</tr>
</tbody>
</table>

2. Take the first risk and multiply the probability by the impact. For opportunities, use a positive cost. For threats, use a negative one. Then do the same for the rest of the risks.

   - High winds: $35\% \times -\$48 = -\$16.80$
   - Mudslide: $5\% \times -\$750 = -\$37.50$
   - Wind generator: $15\% \times \$800 = \$120.00$
   - Truck rental: $10\% \times -\$350 = -\$35.00$

3. Now that you’ve calculated the EMV for each of the risks, you can add them up to find the total EMV for all of them.

\[
EMV = -\$16.80 + -\$37.50 + \$120.00 + -\$35.00 = -\$30.70
\]

If you add $30.70 to the budget, then it should be enough to account for these risks.
You’ll need to know how to do EMV calculations for the test. Give them a shot now—they’re pretty easy once you get the hang of them.

Take a look at this table of risks.

<table>
<thead>
<tr>
<th>Risk</th>
<th>Probability</th>
<th>Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Navigation equipment failure</td>
<td>15%</td>
<td>costs $300 due to getting lost</td>
</tr>
<tr>
<td>Unseasonably warm weather</td>
<td>8%</td>
<td>saves $500 in excavation costs</td>
</tr>
<tr>
<td>Wild animals eat rations</td>
<td>10%</td>
<td>costs $100 for replacement run</td>
</tr>
</tbody>
</table>

1. Calculate the EMV for each of these three risks.

2. If these are the only risks on the project, calculate the total EMV.

3. The latest weather report came out, and there is now a 20% chance of unseasonably warm weather. What’s the new EMV for the project?

4. Now the cost of replacement rations goes up to $150. What’s the new EMV for the project?

Answers on page 554.
Decision tree analysis uses EMV to help you make choices

There’s another way to do EMV—you can do it visually using something called a decision tree. This decision tree shows the hidden costs of whether or not you buy a heavier tent. The tent is more expensive—it costs $350, while the lighter tent costs $130. But the heavier tent has better protection against the wind, so if there are high winds, your equipment isn’t damaged.

The national weather service says there’s a 35% chance of high winds, which means there’s a 65% chance of low winds.

If you buy a heavy tent, then it protects your equipment better, but it’ll cost more. You figure that if there are high winds, you’ll lose $953 worth of equipment with a light tent, but only $48 worth if you have a heavy one. If there are low winds, then you’ll only lose $15 worth with a light tent and $10 worth with a heavy tent.

What’s the EMV – or how much it’s likely to cost you – of choosing the heavier tent?

If we add the EMV for high winds plus the EMV for low winds to the cost of the tent, we’ll figure out the “real” cost of choosing the heavier tent. So that’s $-168.80 + $-6.50 + $-350 = $-373.30.

Compare that with the EMV of choosing the lighter tent. Which decision makes sense?

We can do the same thing for the bottom two branches of the tree. The “cheaper” tent costs $-130 + $-333.55 + $-9.75 = $-473.30. So it’s actually more expensive!
Looking at the decision tree on the facing page, see if you can figure out the expected monetary value depending on the decisions the team makes.

**Hint:** Figure out the new EMV for each branch—that will tell you if the decision makes sense.

1. You hear a weather report that says there’s now a 45% chance of high winds. Does it still make sense to buy the heavier tent?

2. If you don’t buy the heavier tent, then you have room to take along a wind generator that can power your equipment, and that will save you $1,100 in portable batteries if there’s a heavy wind. If there’s still a 45% chance of high winds, does it still make sense to buy the heavier tent?

This is an opportunity. So it should have a POSITIVE value when you do the EMV calculation.

---

**Q:** I still don’t get this Monte Carlo stuff. What’s the deal?

**A:** All you really need to know about Monte Carlo analysis for the test is that it’s a way that you can model out random data using software. In real life, though, it’s a really cool way of trying to see what could happen on your project if risks do occur. Sometimes modeling out the data you already have about your project helps you to see better the real impact of a risk if it did happen.

**Q:** I can figure out how much the risk costs using EMV, or I can do it with Decision Tree Analysis. Why do I need two ways to do this?

**A:** It turns out that there are a lot of EMV techniques, and decision tree analysis is just one of them. But it’s the one you need to know for the test, because it’s the one that helps you make decisions by figuring out the EMV for each option. You can bet that you’ll see a question or two that asks you to calculate the EMV for a project based on decision tree like the one on the facing page. As long as you remember that risks are negative numbers and that opportunities are positive ones, you should do fine.

**Q:** So are both quantitative analysis and qualitative analysis really just concerned with figuring out the impact of risks?

**A:** That’s right. Qualitative analysis focuses on the impact as the team judges it in planning. Quantitative analysis focuses on getting the hard numbers to back up those judgments.

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**Answers on page 555.**
**Update the risk register based on your quantitative analysis results**

When you’ve finished gathering data about the risks, you change your priorities, urgency ratings and categories if necessary and update your risk register. Sometimes modeling out your potential responses to risk helps you to find a more effective way to deal with them.

<table>
<thead>
<tr>
<th>Identified Risks</th>
<th>Potential Response</th>
<th>Root Cause</th>
<th>Category</th>
<th>Priority</th>
<th>Urgency</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Landslide caused by loose gravel and dirt on the nearby mountain</td>
<td>Put up barrier or dig trench</td>
<td>Geological data review found loose topsoil nearby</td>
<td>Natural</td>
<td>High</td>
<td>Medium</td>
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<tr>
<td>2. High winds can lead to cliff disaster</td>
<td>Reinforce tent stakes; obtain weatherproof equipment</td>
<td>National weather service predicts 35% chance of high winds</td>
<td>Natural</td>
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<td>Medium</td>
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<td>3. Truck rental is unavailable</td>
<td>Pay to reserve equipment at a second company</td>
<td>Higher than expected demand for equipment this season</td>
<td>Equipment</td>
<td>High</td>
<td>High</td>
</tr>
<tr>
<td>4. Storms predicted through the first two weeks of project schedule time</td>
<td>Create reserves to account for time lost due to storms</td>
<td>El Niño weather pattern</td>
<td>Natural</td>
<td>Medium</td>
<td>Low</td>
</tr>
<tr>
<td>5. Supply shortage if we don’t accurately predict food needs</td>
<td>Nearest store is 30 miles away</td>
<td>Equipment</td>
<td>Low</td>
<td>High</td>
<td></td>
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<tr>
<td>6. If someone gets sick, it could be a problem getting medical care</td>
<td>Bring a doctor with us on the project</td>
<td>Nearest hospital is 50 miles away</td>
<td>Human</td>
<td>Low</td>
<td></td>
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Outputs

Analysis showed us that this would be the most expensive risk if it were to occur. So it got upgraded to a high priority.

This one got downgraded when quantitative analysis showed that it was not very likely to happen on such a short-term project.
The main output of all of the risk management planning processes is an updated risk register.

The first step in risk management is Risk Identification, where you work with the whole team to figure out what risks could affect your project.

Qualitative and quantitative analysis are all about ranking risks based on their probability and impact.

Qualitative analysis is where you take the categories in your risk plan and assign them to each of the risks that you’ve identified.

Quantitative analysis focuses on gathering numbers to help evaluate risks and make the best decisions about how to handle them.

Decision Tree Analysis is one kind of Expected Monetary Value analysis. It focuses on adding up all of the costs of a decisions being made on a project so that you can see the overall value of risk responses.

To calculate EMV, be sure to treat all negative risks as negative numbers and all opportunities as positive ones. Then add up all of the numbers on your decision tree.

Don’t forget watchlists. They let you monitor lower-priority risks so that you can see if triggers for those risks occur and you need to treat them as higher priorities.

All of the processes in Risk Management are planning or control processes. There are no executing processes here. Since the goal is to plan for risks, there is no need to focus on actually doing the work. By then, it’s too late to plan for risks.

Your risk register should include both threats and opportunities. Opportunities have positive impact values, while threats have negative ones. Don’t forget the plus or minus sign when you’re calculating EMV.
How do you respond to a risk?

After all that analysis, it’s time to figure out what you’re going to do if a risk occurs. Maybe you’ll be able to keep a reserve of money to handle the cost of the most likely risks. Maybe there’s some planning you can do from the beginning to be sure that you avoid it. You might even find a way to transfer some of the risk with an insurance policy.

However you decide to deal with each individual risk, you’ll update your risk responses in the risk register to show your decisions when you’re done. When you’re done with Risk Response planning, you should be able to tell your change control board what your response plans are and who will be in charge of them so they can use them to evaluate changes.

The risk register is the output of all of your analysis so far. It should contain everything you know about the risks facing your project, and even some preliminary responses you might have thought of along the way.

Risk response planning is figuring out what you’ll do if risks happen.
It isn’t always so bad

Remember the strategies for handling negative risks—avoid, mitigate, transfer, and accept—from earlier? Well, there are strategies for handling positive risks, too. The difference is that strategies for positive risks are all about how you can try to get the most out of them. The strategies for handling negative and positive risks are the tools and techniques for the Risk Response Planning process.

1 Exploit
This is when you do everything you can to make sure that you take advantage of an opportunity. You could assign your best resources to it. Or you could allocate more than enough funds to be sure that you get the most out of it.

2 Share
Sometimes it’s harder to take advantage of an opportunity on your own. Then you might call in another company to share in it with you.

3 Enhance
This is when you try to make the opportunity more probable by influencing its triggers. If getting a picture of a rare bird is important, then you might bring more food that it’s attracted to.

4 Accept
Just like accepting a negative risk, sometimes an opportunity just falls in your lap. The best thing to do in that case is to just accept it!

Response planning can even find more risks

Secondary risks are risks that come from a response you have to another risk. If you dig a trench to stop landslides from taking out your camp, it’s always possible for someone to fall into the trench and get hurt.

Residual Risks are those that remain after your risk responses have been implemented. So even though you reinforce your tent stakes and get weatherproof gear, there’s still a chance that winds could destroy your camp if they are strong enough.

I get it. So, I have to go back and analyze secondary risks. But residual risks just sit there, so I can deal with them later.
Which risk response technique is being used in these situations? Match each technique to its scenario.

<table>
<thead>
<tr>
<th>Response Strategy</th>
<th>Scenario</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mitigate</td>
<td>If the weather’s good, then there’s a chance you could see a meteor shower. If the team gets a photo that wins the meteor photo contest, you can get extra funding. You have your team stay up all night with their telescopes and cameras ready.</td>
</tr>
<tr>
<td>Avoid</td>
<td>You hear that it’s going to rain for the first three days of your trip, so you bring waterproof tents and indoor projects for the team to work on in the meantime.</td>
</tr>
<tr>
<td>Accept</td>
<td>You read that there’s a major bear problem in the spring on the cliff where you are planning to work. You change your project start date to happen in the fall.</td>
</tr>
<tr>
<td>Transfer</td>
<td>On your way up the cliff, you meet another team that is looking to survey the area. You offer to do half of the surveying work while they do the other half and then trade your findings with one another.</td>
</tr>
<tr>
<td>Exploit</td>
<td>There’s a high probability of water damage to some of your equipment, so you buy insurance to avoid losses.</td>
</tr>
<tr>
<td>Share</td>
<td>There’s always the chance that someone could make a mistake and fall off the cliff. No matter how much you plan for the unexpected, sometimes mistakes happen.</td>
</tr>
<tr>
<td>Enhance</td>
<td>About 10 years ago a really rare bird, the black-throated blue warbler, was seen on this cliff. If you could get a picture of it, it would be worth a lot of money. So, you bring special seeds that you have read are really attractive to this bird, and you set up lookout points around the cliff with cameras ready to get the shot.</td>
</tr>
</tbody>
</table>

Answers on page 556.
Add risk responses to the register

You guessed it—more updates to the risk register. All of your risk responses will be tracked through change control. Changes that you need to make to the plan will get evaluated based on your risk responses, too. It’s even possible that some of your risk responses will need to be added into your contract.

<table>
<thead>
<tr>
<th>Identified Risks</th>
<th>Potential Response</th>
<th>Root Cause</th>
<th>Risk Owner</th>
<th>Cat</th>
<th>Priority</th>
<th>Urgency</th>
</tr>
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<tr>
<td>1. Landslide caused by loose gravel and dirt on the nearby mountain</td>
<td>Put up barrier or dig trench</td>
<td>Geological data review found loose topsoil nearby</td>
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<td>High</td>
<td>Medium</td>
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<tr>
<td>2. High winds can lead to cliff disaster</td>
<td>Reinforce tent stakes; obtain weatherproof equipment</td>
<td>National weather service predicts 35% chance of high winds</td>
<td>Tanya T.</td>
<td>Natural</td>
<td>High</td>
<td>Medium</td>
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<tr>
<td>3. Truck rental is unavailable</td>
<td>Pay to reserve equipment at a second company</td>
<td>Higher than expected demand for equipment this season</td>
<td>Joe S.</td>
<td>Equipment</td>
<td>High</td>
<td>High</td>
</tr>
<tr>
<td>4. Storms predicted through the first two weeks of project schedule time</td>
<td><strong>Buy storm insurance in case the equipment is damaged</strong></td>
<td>El niño weather pattern</td>
<td>Michael R.</td>
<td>Natural</td>
<td>Medium</td>
<td>Low</td>
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<tr>
<td>5. Supply shortage if we don’t accurately predict food needs</td>
<td></td>
<td>Nearest store is 30 miles away</td>
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<td>6. If someone gets sick, it could be a problem getting medical care</td>
<td>Bring a doctor with us on the project</td>
<td>Nearest hospital is 50 miles away</td>
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<td>Human</td>
<td>Low</td>
<td>Low</td>
</tr>
<tr>
<td>7. Someone could fall in the landslide trench</td>
<td>Set up a trench patrol to make sure no one gets hurt</td>
<td>Dig trench for landslides</td>
<td>Joe S.</td>
<td>Human</td>
<td>Low</td>
<td>Low</td>
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You guessed it—more updates to the risk register. All of your risk responses will be tracked through change control. Changes that you need to make to the plan will get evaluated based on your risk responses, too. It’s even possible that some of your risk responses will need to be added into your contract.

During risk response planning, the team agreed to buy insurance for this one.

**Outputs**

- Every risk needs to have one person who owns the response plan.
- Sometimes you’ll need to change the contract to account for risks.
- This is a secondary risk that is caused by the response to risk #1.
- The PM plan needs to be updated so that Integrated Change Control can include the risk responses.

**Project Management Plan Updates**

**Contract updates**

**Project Risk Management**

---

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<td>El niño weather pattern</td>
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<td>Medium</td>
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<tr>
<td>7. Someone could fall in the landslide trench</td>
<td>Set up a trench patrol to make sure no one gets hurt</td>
<td>Dig trench for landslides</td>
<td>Joe S.</td>
<td>Human</td>
<td>Low</td>
<td>Low</td>
</tr>
</tbody>
</table>

Every risk needs to have one person who owns the response plan.

During risk response planning, the team agreed to buy insurance for this one.

**Outputs**

- Every risk needs to have one person who owns the response plan.
- Sometimes you’ll need to change the contract to account for risks.
- This is a secondary risk that is caused by the response to risk #1.
- The PM plan needs to be updated so that Integrated Change Control can include the risk responses.

**Project Management Plan Updates**

**Contract updates**

**Project Risk Management**
**Head First:** We’ve seen you hanging out on cliffs for a while now. Apparently, you’ve been paying people to stand on the cliff for you or getting a friend to hold a trampoline at the foot of the cliff; we’ve even seen you jump off of it. So now that I’ve finally got a chance to interview you, I want to ask the question at the top of everyone’s mind: “Are you insane? Why do you spend so much time up there?”

**Stick Figure:** First off, let me dispel a few myths that are flying around out there about me. I’m not crazy, and I’m not trying to get myself killed! Before Risk Management entered my life I, like you, would never have dreamed of doing this kind of thing.

**Head First:** Okay, but I’m a little skeptical about your so-called “Risk Management.” Are you trying to say that because of Risk Management you don’t have to worry about the obvious dangers of being up there?

**Stick Figure:** No. Of course not! That’s not the point at all. Risk Management means you sit down and make a list of all of the things that could go wrong. (And even all the things that could go right.) Then you really try to think of the best way to deal with anything unexpected.

**Head First:** So you’re doing this Risk Management stuff to make it less dangerous for you?

**Stick Figure:** Yes, exactly! By the time I’m standing up there on that cliff, I’ve really thought my way through pretty much everything that might happen up there. I’ve thought through it both qualitatively and quantitatively.

**Head First:** Quantitatively?

**Stick Figure:** Yes. You don’t think I’d go up there without knowing the wind speed, do you? Chance of landslides? Storms? The weight of everything I’m carrying? How likely I am to fall in weather conditions? I think about all of that and I measure it. Then I sit down and come up with risk response strategies.

**Head First:** OK, so you have strategies. Then what?

**Stick Figure:** Then I constantly monitor my risks while I’m on the cliff. If anything changes, I check to see if it might trigger any of the risks I’ve come up with. Sometimes I even discover new risks while I’m up there. When I do, I just add them to the list and work on coming up with responses for them.

**Head First:** I see. So you’re constantly updating your list of risks.

**Stick Figure:** Yes! We call it a **Risk Register**. Whenever I have new information, I put it there. It means that I can actually hang out on these cliffs with a lot of confidence. Because, while you can’t guarantee that nothing will go wrong, you can be prepared for whatever comes your way.

**Head First:** That’s a lot of work. Does it really make a difference?

**Stick Figure:** Absolutely! I’d never be able to sleep at night knowing that I could fall off the cliff at any time. But I’ve planned for the risks, and I’ve taken steps to stay safe… and I sleep like a baby.
You can’t plan for every risk at the start of the project

Even the best planning can’t predict everything—there’s always a chance that a new risk could crop up that you hadn’t thought about. That’s why you need to constantly monitor how your project is doing compared to your risk register. If a new risk happens, you have a good chance of catching it before it causes serious trouble. When it comes to risk, the earlier you can react, the better for everybody. And that’s what the **Risk Monitoring and Control process** is all about.

There have been reports of bears causing problems for people around here lately. Be careful out here.

The park ranger’s come by to let you know about some recent bear sightings on this cliff.

The risk register doesn’t say anything about handling bears. Looks like this is a new risk altogether...
Risk monitoring and control is another change control process

Risks responses are treated just like changes. You monitor the project in every status meeting to see how the risks in the risk register are affecting it. If you need to implement a risk response, you take it to your change control board because it amounts to a change that will affect cost, quality, or schedule.

You compare all of your actual data to your plans using the Risk Register and the PM Plan.

As change requests are implemented, new risks can be uncovered.

Status reports, metrics, and other work outputs should be reviewed to see if risks are happening.

You should keep monitoring your risks at every meeting until the project is closed.

**Weekly Meeting Agenda**

1. Review work performance information and earned value numbers
2. Examine performance reports.
   - What have people gotten done?
   - Have any risks occurred that require implementation of a risk response strategy?
   - Have we identified any new risks that need to be analyzed?
How to control your risks

Controlling risks means keeping your finger on the pulse of the project. If you are constantly reviewing all of the data your project is producing, you will be able to react quickly if a new risk is uncovered or if it looks like one of your response strategies needs to spring into action. Without careful monitoring, even your best plans won’t get implemented in time to save your project if a risk happens.

Risk reassessment

You should have some regularly scheduled reassessment meetings to go over all of the information you have to date and see if your risk register still holds true. In a reassessment, your main goal is to find any new risks that have come up. That’s why it’s important to reassess your risk register every so often and be sure that all of the risks in it are still the right ones.

Variance and trend analysis

Comparing the actual project performance to the plan is a great way to tell if a risk might be happening. If you find that you’re significantly over budget or behind schedule, a risk could have cropped up that you didn’t take into account. Looking for trends in your defects or schedule variance, for example, might show patterns that indicate that risks have occurred before you would have found that out on your own.

Reserve analysis

Just like you keep running tabs on your budget, you should always know how much money you have set aside for risk response. As you spend it, you should be sure to subtract it so you know if you have enough to cover all of your remaining risks. If you start to see that your reserves are running low and there are still a lot of risks being identified, you might be in trouble. Keeping tabs on your reserve means that you will always know if you need to reserve more funds or make different choices about how to handle risks as they come up.

Sometimes this kind of reserve is called a “contingency” because its use is contingent on a certain risk happening.
More risk monitoring and control techniques

There are just a few more tools in the Risk Monitoring and Controlling process. They’re all focused on finding new risks if they crop up, dealing with changes to the risks you’ve already planned for, and responding quickly to risks you know how to handle.

**Risk audits** are when you have an outside party come in and take a look at your risk response strategies to judge how effective they are. Sometimes risk audits will point out better ways of handling a specific risk so that you can change your response strategy going forward.

**Technical performance measurement** means comparing the performance of your project with its planned performance. So if you expected to hit a specific milestone, you could check performance information on your product at that time to see if it measured up to the plan. If not, that might indicate that there are risks you didn’t plan for.

**Status meetings** are the most important way to keep the team up to date on risk planning—so important that they should happen throughout the entire project. The more you talk about risks with the team, the better. Every single status meeting should have risk review on the agenda. Status meetings are a really important way of noticing when things might go wrong, and of making sure that you implement your response strategy in time. It’s also possible that you could come across a new opportunity by talking to the team.

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*Tools*

Never stop looking for new risks and adapting your strategies for dealing with them.

*Auditors will also look at how effective your overall processes for risk planning are.*
Here are some risk monitoring and control activities. Can you determine which of the tools is being used in each one?

1. At every milestone, you do a new round of risk identification and make sure that the risks in your risk register still apply to the project.

☐ Reassessment    ☐ Audit
☐ Technical Performance Measurement
☐ Trend Analysis    ☐ Reserve Analysis

2. You check to make sure that you have all of the features developed in your project that you had planned when you reach the “feature complete” milestone. When you find that you are missing one of the planned features, you realize that a new risk has shown up—you missed one of the required features in your functional specification.

☐ Reassessment    ☐ Audit
☐ Technical Performance Measurement
☐ Trend Analysis    ☐ Reserve Analysis

3. You take a look at the number of defects you have found in your project per phase and find that it is higher in your project than it has been in most other projects that the company is doing. You dig a little deeper and find some previously unplanned risks that have been causing trouble on your project.

☐ Reassessment    ☐ Audit
☐ Technical Performance Measurement
☐ Trend Analysis    ☐ Reserve Analysis

4. Your company sends a risk expert in to take a look at your risk response strategies. She finds that you are missing a few secondary risks that might be caused by the responses you have planned. So you update your risk register to include the secondary risks.

☐ Reassessment    ☐ Audit
☐ Technical Performance Measurement
☐ Trend Analysis    ☐ Reserve Analysis

5. You decide to implement a risk response that costs $4,000. You check to make sure that you have enough money to cover the rest of the risks that might happen from here on out in the project.

☐ Reassessment    ☐ Audit
☐ Technical Performance Measurement
☐ Trend Analysis    ☐ Reserve Analysis

Answers:
1. Reassessment
2. Technical Performance Measurement
3. Trend Analysis
4. Audit
5. Reserve Analysis
**Q:** Why do I need to ask about risks at every status meeting?

**A:** Because a risk could crop up at any time, and you need to be prepared. The better you prepare for risks, the more secure your project is against the unknown. That’s also why the triggers and watchlists are really important. When you meet with your team, you should figure out if a trigger for a risk response has happened. And you should check your watchlist to make sure none of your low-priority risks have materialized.

For the test, you need to know that status meetings aren’t just a place for you to sit and ask each member of your team to tell you their status. Instead, you use them to figure out decisions that need to be made to keep the project on track or to head off any problems that might be coming up. In your status meetings, you need to discuss all of the issues that involve the whole team and come up with solutions to any new problems you encounter. So, it makes sense that you would use your status meetings to talk about your risk register and make sure that it is always up to date with the latest information.

**Q:** I still don’t get trend analysis. How does it help me find risks?

**A:** It’s easy to miss risks in your project—sometimes all the meetings in the world won’t help your team see some of them. That’s why a tool like trend analysis can be really useful. Remember the control chart from the Quality Management chapter? This is really similar, and it’s just as valuable. It’s just a way to see if things are happening that you did not plan for.

**Q:** Hey, didn’t you talk about risks back in the Time Management chapter too?

**A:** Wow—it’s great that you remembered that! The main thing to remember about risks from the Time Management chapter is that having multiple critical paths means you have a riskier project. The riskiest is when all of the activities are on the critical path. That means that a delay to even one activity can derail your whole project.

**Q:** Shouldn’t I ask the sponsor about risks to the project?

**A:** Actually the best people to ask about risks is the project team itself. The sponsor knows why the project is needed and how much money is available for it, but from there, it’s really up to the team to manage risks. Since you are the ones doing the work, it makes sense that you would have a better idea of what has gone wrong on similar projects and what might go wrong on this one. Risk Identification, analysis, and response planning are some of the most valuable contributions the team makes to the project. They can be the difference between making the sponsor happy and having to do a lot of apologizing.

**Q:** Why do we do risk audits?

**A:** Risk audits are when you have someone from outside your project come in and review your risk register—your risks and your risk responses—to make sure you got it right. The reason we do it is because risks are so important that getting a new set of eyes on them is worth the time.

**Q:** Hold on, didn’t we already talk about reserves way back in Cost Control? Why is it coming up here?

**A:** That’s right, back in Chapter 7 we talked about a management reserve, which is money set aside to handle any unknown costs that come up on the project. That’s a different kind of reserve than the one for controlling risks. The kind of reserve used for risks is called a contingency reserve, because its use is contingent on a risk actually materializing.

Project managers sometimes talk about both kinds of reserves together, because they both have to show up on the same budget. When they do, you’ll sometimes hear talk of “known unknowns” and “unknown unknowns.” The management reserve is for unknown unknowns—things that you haven’t planned for but could impact your project. The contingency reserve is for known unknowns, or risks that you know about and explicitly planned for and put in your risk register.

The better you prepare for risks, the more secure your project is against the unknown.
By now, you know what comes out of a typical Monitoring & Controlling process. Draw in the missing outputs for Risk Monitoring and Controlling.

**Risk Monitoring and Controlling**

You’ll find all sorts of things that need to be fixed. But you can’t just go update the plan—you need this as an input to kick off change control.

Risk Register Updates

This one’s all about helping others to learn from what’s happened on your project.

Project Management Plan Updates

For these two, think about what you do once you have evaluated work performance information and found that something needs to happen.
By now, you know what comes out of a typical Monitoring & Controlling process. Draw in the missing outputs for Risk Monitoring and Controlling.

Risk monitoring and control is exactly like the other change control processes.

We added a risk to the register to account for a bear coming into the camp.
Meanwhile...

It's a little windy out here...

I'd better check my risk register.

Good thing I planned to bring this weatherproof tent.

What's that sound?

Rustle Rustle Rustle

Risk planning to the rescue!

I'll use the bear spray...

Grrrr!

Looks like falling is the best option.

... And I'm safe. Mission accomplished!

* Note from the authors: We're not exactly sure why he feels his mission was accomplished after spraying a bear in the face and then jumping off of a cliff. But it seems to work!
117. Which of the following is not a Quantitative Analysis technique?

A. Sensitivity analysis
B. Expected monetary value
C. Reserve analysis
D. Monte Carlo analysis

This one is definitely a quantitative analysis technique. Multiplying probability with the value of positive and negative outcomes of the project is all about putting numbers to risk.

Hmm. This one doesn’t look quite right. It’s about numbers. But it isn’t concerned with assigning numbers to the risk. It’s about assigning numbers to the contingency reserve. This might be the right answer.

D has to be the answer! This one is about using random numbers to model out possible risks on the project. It’s definitely a part of quantitative analysis.

Take your time answering Which-is-NOT questions. Take your time and think your way through it. All of them will have something in common but one. As long as you remember the group you’re fitting them into, you won’t have any trouble.
HEAD LIBS

Fill in the blanks to come up with your own “Which-is-Not” question!

Which of the following is NOT a _______?

(Input, output, tool, process, or concept)

A. ____________________________

(Input, output, tool, or process that is in the group)

B. ____________________________

(Input, output, tool, or process that is in the group)

C. ____________________________

(Input, output, tool, or process that is in the group)

D. ____________________________

(The right answer)

Join the Head First PMP community at http://www.headfirstlabs.com/PMP
You can add your Head Libs answer, and see what Head Libs other project managers came up with!
Take a look at this table of risks.

<table>
<thead>
<tr>
<th>Risk</th>
<th>Probability</th>
<th>Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Navigation equipment failure</td>
<td>15%</td>
<td>costs $300 due to getting lost</td>
</tr>
<tr>
<td>Unseasonably warm weather</td>
<td>8%</td>
<td>save $500 in excavation costs</td>
</tr>
<tr>
<td>Wild animals eat rations</td>
<td>10%</td>
<td>costs $100 for replacement run</td>
</tr>
</tbody>
</table>

1. Calculate the EMV for each of these three risks.

   - Navigation equipment failure: $300 \times 0.15 = -\$45.00$
   - Unseasonably warm weather: $500 \times 0.08 = \$40.00$
   - Wild animals eat rations: $100 \times 0.10 = -\$10.00$

2. If these are the only risks on the project, calculate the total EMV.

   \[ \text{Total EMV} = -\$45.00 + \$40.00 + -\$10.00 = -\$15.00 \]

3. The latest weather report came out, and there is now a 20% chance of unseasonably warm weather. What’s the new EMV for the project?

   - Unseasonably warm weather: $500 \times 0.20 = \$100.00$
   - The new total EMV = \$100.00 - \$15.00 = \$45.00

4. Now the cost of replacement rations goes up to $150. What’s the new EMV for the project?

   - Wild animals eat rations: $150 \times 0.10 = -\$15.00$
   - The new total EMV = -\$45.00 + \$100.00 + -\$15.00 = \$40.00
Looking at the decision tree on the facing page, see if you can figure out the expected monetary value depending on the decisions the team makes.

1. You hear a weather report that says there’s now a 45% chance of high winds. Does it still make sense to buy the heavier tent?

   - **EMV of choosing the heavier tent:** $-\$350 + (45\% \times -\$48) + (55\% \times -\$10) = -\$377.10$
   - **EMV of choosing the lighter tent:** $-\$130 + (45\% \times -\$953) + (55\% \times -\$15) = -\$567.10$

   **It still makes sense to choose the heavier tent.**

2. If you don’t buy the heavier tent, then you have room to take along a wind generator that can power your equipment, and that will save you $1100 in portable batteries if there’s a heavy wind. If there’s still a 45% chance of high winds, does it still make sense to buy the heavier tent?

   - **EMV of choosing the heavier tent:** $-\$350 + (45\% \times -\$48) + (55\% \times -\$10) = -\$377.10$
   - **EMV of choosing the lighter tent:** $-\$130 + (45\% \times -\$953) + (55\% \times -\$15) = -\$72.10$

   **Now it makes sense to choose the lighter tent.**

So where did this $147 come from? Well, if there’s a heavy wind, then the generator turns this into an opportunity. You’ll still see $953 in equipment damage, but that’s offset by the $1,100 in savings for portable batteries. That puts you ahead by $147—but only if there’s a
Which risk response technique is being used in these situations? Match each technique to its scenario.

**Mitigate**

If the weather’s good, then there’s a chance you could see a meteor shower. If the team gets a photo that wins the meteor photo contest, you can get extra funding. You have your team stay up all night with their telescopes and cameras ready.

**Avoid**

You hear that it’s going to rain for the first three days of your trip, so you bring waterproof tents and indoor projects for the team to work on in the meantime.

**Accept**

You read that there’s a major bear problem in the spring on the cliff where you are planning to work. You change your project start date to happen in the fall.

**Transfer**

On your way up the cliff, you meet another team that is looking to survey the area. You offer to do half of the surveying work while they do the other half and then trade your findings with one another.

**Exploit**

There’s a high probability of water damage to some of your equipment, so you buy insurance to avoid losses.

**Share**

There’s always the chance that someone could make a mistake and fall off the cliff. No matter how much you plan for the unexpected, sometimes mistakes happen.

**Enhance**

About 10 years ago a really rare bird, the black-throated blue warbler, was seen on this cliff. If you could get a picture of it, it would be worth a lot of money. So, you bring special seeds that you have read are really attractive to this bird, and you set up lookout points around the cliff with cameras ready to get the shot.
Exam Questions

1. The project manager for a construction project discovers that the local city council may change the building code to allow adjoining properties to combine their sewage systems. She knows that a competitor is about to break ground in the adjacent lot and contacts him to discuss the possibility of having both projects save costs by building a sewage system for the two projects.

This is an example of which strategy?

A. Mitigate
B. Share
C. Accept
D. Exploit

2. Which of the following is NOT a risk response technique?

A. Exploit
B. Transfer
C. Mitigate
D. Confront

3. You are using an RBS to manage your risk categories. What process are you performing?

A. Risk Planning
B. Risk Identification
C. Qualitative Analysis
D. Quantitative Analysis

4. Which of the following is used to monitor low priority risks?

A. Triggers
B. Watchlists
C. Probability and Impact Matrix
D. Monte Carlo analysis
5. You’re managing a construction project. There’s a 30% chance that weather will cause a three-day delay, costing $12,000. There’s also a 20% chance that the price of your building materials will drop, which will save $5,000. What’s the total EMV for both of these?

A. $-3,600
B. $1,000
C. $-2,600
D. $4,600

6. Joe is the project manager of a large software project. When it’s time to identify risks on his project, he contacts a team of experts and has them all come up with a list and send it in anonymously. What technique is Joe using?

A. SWOT
B. Ishikawa diagramming
C. Delphi
D. Brainstorming

7. Susan is project manager on a construction project. When she hears that her project has run into a snag due to weeks of bad weather on the job site, she says “No problem, we have insurance that covers cost overruns due to weather.” What risk response strategy did she use?

A. Exploit
B. Transfer
C. Mitigate
D. Avoid

8. You’re performing risk identification on a software project. Two of your team members have spent half of the meeting arguing about whether or not a particular risk is likely to happen on the project. You decide to table the discussion, but you’re concerned that your team’s motivation is at risk. The next item on the agenda is a discussion of a potential opportunity on the project in which you may be able to purchase a component for much less than it would cost to build.

Which of the following is NOT a valid way to respond to an opportunity?

A. Exploit
B. Transfer
C. Share
D. Enhance
9. Risks that are caused by the response to another risk are called
   A. Residual risks
   B. Secondary risks
   C. Cumulative risks
   D. Mitigated risks

10. What's the main output of the Risk Management processes?
    A. The Risk Management Plan
    B. The Risk Breakdown Structure
    C. Work Performance Information
    D. The Risk Register

11. Tom is a project manager for an accounting project. His company wants to streamline its payroll system. The project is intended to reduce errors in the accounts payable system and has a 70% chance of saving the company $200,000 over the next year. It has a 30% chance of costing the company $100,000.

What's the project's EMV?
   A. $170,000
   B. $110,000
   C. $200,000
   D. $100,000

12. What's the difference between management reserves and contingency reserves?
    A. Management reserves are used to handle known unknowns, while contingency reserves are used to handle unknown unknowns.
    B. Management reserves are used to handle unknown unknowns, while contingency reserves are used to handle known unknowns.
    C. Management reserves are used to handle high-priority risks, while contingency reserves are used to handle low-priority risks.
    D. Management reserves are used to handle low-priority risks, while contingency reserves are used to handle high-priority risks.
13. How often should a project manager discuss risks with the team?
   A. At every milestone
   B. Every day
   C. Twice
   D. At every status meeting

14. Which of the following should NOT be in the risk register?
   A. Watchlists of low-priority risks
   B. Relative ranking of project risks
   C. Root causes of each risk
   D. Probability and impact matrix

15. Which of the following is NOT true about risk management?
   A. The project manager is the only person responsible for identifying risks
   B. All known risks should be added to the risk register
   C. Risks should be discussed at every team meeting
   D. Risks should be analyzed for impact and priority

16. You’re managing a project to remodel a kitchen. You find out from your supplier that there’s a 50% chance that the model of oven that you planned to use may be discontinued, and you’ll have to go with one that costs $650 more. What’s the EMV of that risk?
   A. $650
   B. −$650
   C. $325
   D. −$325

17. Which risk analysis tool is used to model your risks by running simulations that calculate random outcomes and probabilities?
   A. Monte Carlo analysis
   B. Sensitivity analysis
   C. EMV analysis
   D. Delphi technique
Exam Questions

18. A construction project manager has a meeting with the team foreman, who tells him that there’s a good chance that a general strike will delay the project. They brainstorm to try to find a way to handle it, but in the end decide that if there’s a strike, there is no useful way to minimize the impact to the project. This is an example of which risk response strategy?

   A. Mitigate
   B. Avoid
   C. Transfer
   D. Accept

19. You’re managing a project to fulfill a military contract. Your project team is assembled, and work has begun. Your government project officer informs you that a supplier that you depend on has lost the contract to supply a critical part. You consult your risk register and discover that you did not plan for this. What’s the BEST way to handle this situation?

   A. Consult the probability and impact matrix
   B. Perform quantitative and qualitative risk analysis
   C. Recommend preventive actions
   D. Look for a new supplier for the part

20. Which of the following BEST describes risk audits?

   A. The project manager reviews each risk on the risk register with the team
   B. A senior manager audits your work and decides whether you’re doing a good job
   C. An external auditor reviews the risk response strategies for each risk
   D. An external auditor reviews the project work to make sure the team isn’t introducing new risk
1. Answer: B
Sharing is when a project manager figures out a way to use an opportunity to help not just her project but another project or person as well.

2. Answer: D
Confronting is a conflict resolution technique.

2. Which of the following is NOT a risk response technique?
A. Exploit

3. Answer: A
You use an RBS to figure out and organize your risk categories even before you start to identify them. Then you decompose the categories into individual risks as part of risk identification.

4. Answer: B
Your risk register should include watchlists of low priority risks, and you should review those risks at every status meeting to make sure that none of them have occurred.

5. Answer: C
The expected monetary value (or EMV) of the weather risk is the probability (30%) times the cost ($12,000), but don’t forget that since it’s a risk, that number should be negative. So its EMV is 30% x -$12,000 = -$3,600. The building materials opportunity has an EMV of 20% x $5,000 = $1,000. Add them up and you get -$3,600 + $1,000 = -$2,600.

When you’re calculating EMV, negative risks give you negative numbers.
6. Answer: C
Using the Delphi technique, experts supply their opinions of risks for your project anonymously so that they each get a chance to think about the project without influencing each other.

6. Joe is the project manager of a large software project. When it’s time to identify risks on his project, he contacts a team of experts and has them all come up with a list and send it in anonymously. What technique is Joe using?

D. Brainstorming

7. Answer: B
Susan bought an insurance policy to cover cost overruns due to weather. She transferred the risk from her company to the insurance company.

8. Answer: B
You wouldn’t want to transfer an opportunity to someone else! You always want to find a way to use that opportunity for the good of the project. That’s why the response strategies for opportunities are all about figuring out ways to use the opportunity to improve your project (or another, in the case of sharing).

9. Answer: B
A secondary risk is a risk that could happen because of your response to another risk.

10. Answer: D
Most of the processes of Risk Management are about creating or updating the Risk Register.

11. Answer: B
$200,000 \times 0.70 = $140,000 savings, and $100,000 \times 0.30 = -$30,000 expenses. Add them together and you get $110,000.
12. Answer: B

Contingency reserves are a way to do risk response planning. You can think of a risk as a “known unknown”—an uncertain event that you know about, but which may not happen—and you can add contingency reserves to your budget in order to handle them. Management reserves are part of Cost Management – you use them to build a reserve into your budget for any unknown events that happen.

13. Answer: D

Risk monitoring and response is so important that you should go through your risk register at every status meeting!

14. Answer: D

The probability and impact matrix is a tool that you use to analyze risks. You might find it in your project management plan, but it’s not included in the risk register.

15. Answer: A

It’s really important that you get the entire team involved in risk response planning. The more people who look for risks, the more likely it is that you’ll find the ones that will actually occur on your project.

16. Answer: D

Even though this looks a little wordy, it’s just another EMV question. The probability of the risk is 50%, and the cost is -$650, so multiply the two and you get -$325.

17. Answer: A

This is just the definition of Monte Carlo analysis. That’s where you use a computer simulation to see what different random probability and impact values do to your project.
18. Answer: D

There are some risks that you just can’t do anything about. When that happens, you have to accept them. But at least you can warn your stakeholders about the risk, so nobody is caught off guard.

19. Answer: D

You’ve got an unplanned event that’s happened on your project. Is that a risk? No. It’s a project problem, and you need to solve that problem. Your probability and impact matrix won’t help, because the probability of this happening is 100%—it’s already happened. No amount of risk planning will prevent or mitigate the risk. And there’s no sense in trying to take preventive actions, because there’s no way you can prevent it. So the best you can do is start looking for a new part supplier.

20. Answer: C

It’s a good idea to bring in someone from outside of your project to review your risks. The auditor can make sure that each risk response is appropriate and really addresses the root causes of each risk.