

# NIMS CAM Level I Preparation Guide

## Milling

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# Overview

## Introduction

This preparation guide or test advisor is intended to help CAM Programmers study and prepare for the National Institute for Metalworking Skills (NIMS) written credentialing exam. The sample test will help prepare CAM Programmers to take the actual credentialing exam. This preparation guide is useful for reviewing technical knowledge and identifying areas of strength and deficiency needed so the student has what is needed to do well on the exam.

Achieving a NIMS credential is a means through which CAM Programmers can prove their abilities to themselves, their instructors, their employers and/or to the customer. A valuable and portable credential is earned by passing the NIMS credentialing exam. Due to the challenging nature of this test, it proves that a nationally accepted level of competency has been reached.

## Who Wrote the Questions?

A panel of technical experts, from all areas of the CAM industry, wrote the questions used on the actual credentialing exam. The panel of experts ranged from company presidents and owners, to engineers and quality personnel, to current CNC Programmers. Exam questions are designed to test the knowledge skills needed for entry-level CAM Programmers. They are written to deal with practical problems, computations, and decisions CAM Programmers encounter in their day-to-day work.

The technical experts must first validate the exam questions. Then, before the questions become part of the credentialing exam, qualified CAM Programmers and industry personnel validate them once again on a national level. Rejected questions are either rewritten or discarded altogether.

## How to Prepare for the Credentialing Exam

Become familiar with the exam content and question format by utilizing the tools provided in this preparation guide. The Exam Specifications portion in this guide contains a summary description of the content covered by the actual credentialing exam. The Task List describes competencies for each particular area associated with the credentialing area.

The questions are a variation of multiple-choice and true & false. Note that instructions may accompany some questions. Be sure to read each question carefully (twice, if necessary) so that you know exactly what is being asked. Check each answer and your work since an error in computation or understanding may make a wrong answer appear correct.

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The following four steps are suggested for effective preparation:

- Step 1: Study the content list for each exam you will attempt.
- Step 2: Complete the necessary lessons and exercises within the course content being sure to get feedback from your instructor. Do NOT attempt to proceed with the exam if you are not competent in using the CAM Software to create CAD drawings and 2D Toolpaths for a CNC Milling Machine.
- Step 3: Review the sample test to become familiar with subject matter and question type. This is a very important step.
- Step 4: Repeat steps 1 through 3 and identify the area(s) where you may need additional review. Use the preparation guide as a self-diagnostic tool.

### Areas of Knowledge Measured by the Exam

#### *Exam Sections*

The exam is divided into four major sections. They are:

- Process Planning
- 2D Sketching and 3D Modeling
- Setups - Milling
- 2D Milling Toolpaths
- The knowledge and skills you will need to pass the credentialing exam are as follows:

The following is a list of the basic knowledge areas assessed by the exam.

**Process Planning:** The CAM Programmer must be able to read and understand a technical drawing and use their knowledge to plan the toolpaths required to machine the part on a CNC Machining. This will include determining the equipment and material available to the programmer including but not limited to:

- CNC Machines
- Tooling
- Fixtures
- Material

**2D Sketching and 3D Modeling:** The CAM Programmer must be able to use CAD software to draw 2 and 3 dimensional wireframe geometry and Solid Models accurately to replicate the technical drawing of the part they will be programming.

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**Setups - Milling:** The CAM Programmer must be able to setup the CAM System to position the part properly in both the CAM System to accurately position the Material on the CNC Machine. This must be done in a way that effectively communicates these positions to the CNC Machine operator.

**2D Milling Toolpaths:** The exam will test the knowledge of the student in various Toolpaths used in a CAM system. This will ensure that the student understands how to use the toolpaths in an effective way to machine the part as quickly, accurately and safely as possible utilizing the tooling and fixtures available.

### Before the Exam

Get a good night's rest before the exam. Being well rested will make you more alert and efficient when taking the exam. Review any course material from your instructor. Review the test advisor information and sample test. If you wish to pace yourself, bring a watch, or be aware of the location of clocks at the test site. Make sure to bring some form of identification, any necessary paperwork from NIMS and arrive at the test site at least 10 to 15 minutes prior to the specified exam time.

### At the Testing Site

When you arrive at the test center, wait in the assigned area until the proctor begins the test orientation and administration. The proctor will instruct you on the proper procedure for filling out any information on the answer sheet, the time allotted for the exam, reference materials that can be used and if a calculator is permissible.

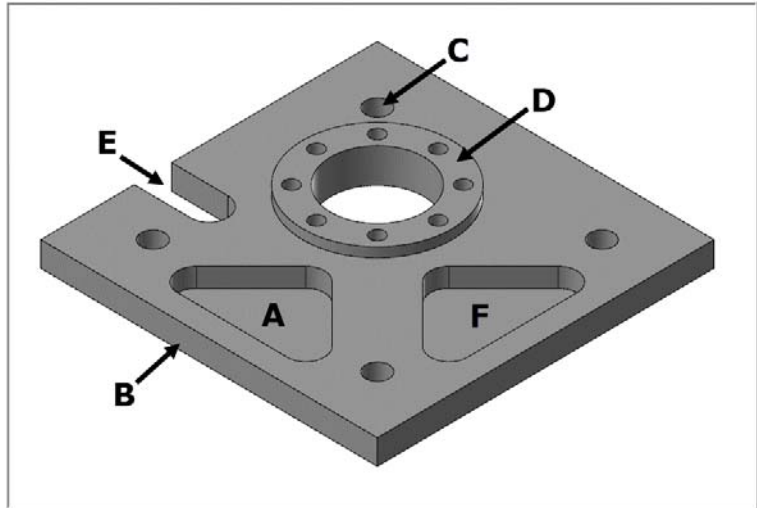
Once the exam has begun, keep track of time. Avoid spending too much time on any one question. Answer the questions you know the answers to and then go back to those you have difficulty with if time allows. Repeat this process for each section. Again, do not spend an excessive amount of time on any one question.

It is to your advantage to answer every question. Do not leave any answers blank. Answers that are left blank will be counted as incorrect. Your score will be based on the number of correct answers.

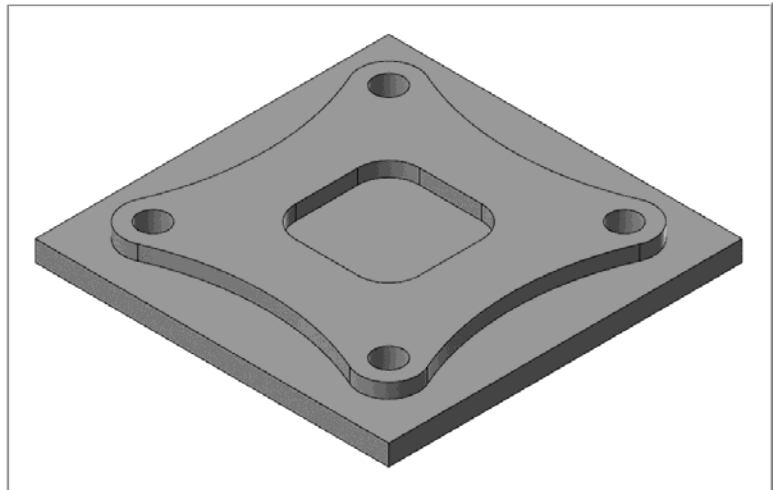
## CAM Level 1 Sample Exam – Milling

### Process Planning

1. What toolpath can be used to machine out the area marked E in the image below:
  - a) Pocket
  - b) Contour
  - c) Both Pocket and Contour
  - d) Neither Pocket nor Contour

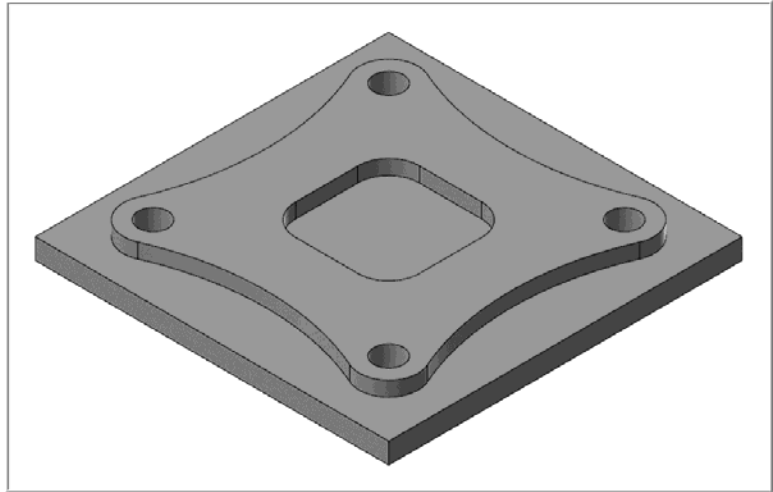


2. When cutting the boss, if climb milling is desired, which direction will the cutter travel?
  - a) Clockwise
  - b) Counter Clockwise
  - c) Left
  - d) Right

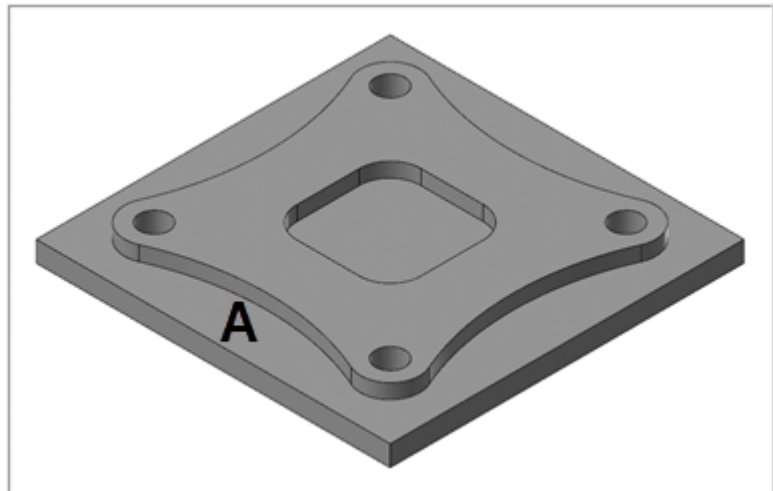


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3. When cutting the pocket, if climb milling is desired, which direction will the cutter travel?
- a) Clockwise
  - b) Counter Clockwise
  - c) Left
  - d) Right

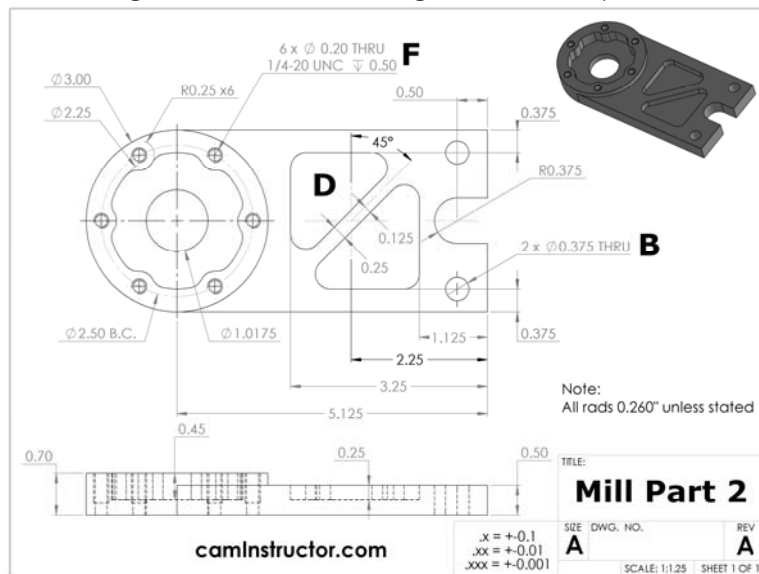


4. When using Contour to cut feature A, the boss, which cut parameter needs to be turned on to machine the entire face of the step if the cutter used is not as wide as the step?
- a) Depth Cuts
  - b) Lead In/Out
  - c) Multi Passes
  - d) Tabs



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Please using the following Mill Part 2 Drawing to answer questions 5, 6, 7 and 8:



- Referencing the Mill Part 2 Drawing, Rev A, what is the largest diameter cutter that can be used to machine out section D.
  - 1/2"
  - 1/4"
  - 3/8"
  - 3/4"
- Referencing the Mill Part 2 Drawing, Rev A, what is the largest diameter cutter that can be used to machine out section G.
  - 1/2"
  - 1/4"
  - 3/8"
  - 3/4"
- Referencing the Mill Part 2 Drawing, Rev A, which tools are required for machining the 6 holes referenced by the letter F?
  - 1/4" - 20 tap and #10 drill
  - 1/4" tap and 1/4" drill
  - 1/4" -20 tap drill
  - single point threading tool and #10 drill

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8. Referencing the Mill Part 2 Drawing, which tools are required to machine the two 0.375" holes reference by the letter B?
- a) Drill and Milling cutter
  - b) 1/4" drill & 3/8" drill
  - c) Drill and Reamer
  - d) Reamer
9. In Absolute Programming, your tool will always be based from the:
- a) Origin point
  - b) Datum feature Reference
  - c) Nearest Concentric Circles tangent arc
  - d) Deepest Hole
10. When the compensation type is set to Control, what information would be input about the tools radius/diameter into the CNC control?
- a) Radius/Diameter is set to 0
  - b) Radius/Diameter is set the same as used in the CNC software
  - c) Radius/Diameter is set the same as the tool used
  - d) None of the above
11. When rotating geometry or a toolpath, which direction is a positive rotation?
- a) CW - Clockwise
  - b) CCW - Counter Clockwise
12. When utilizing an off the shelf fixturing solution, like a Kurt Vise, how can you best account for its geometry in a CNC program?
- a) Search the manufacturers website to find a relevant CAD model that can be inserted
  - b) Fixtures are only for looks in a CNC program
  - c) Make assumptions based on images of similar work holding solutions
  - d) Use additional stock to avoid clearance issues with fixtures.



## 2D Sketching and 3D Modeling

1. Which sequence best represents the stages of part design and manufacturing?
  - a) CNC, CAD, NC
  - b) NC, CAD, CNC
  - c) CAD, CNC, NC
  - d) CAD, NC, CNC
  
2. Boolean operations allow you to remove material from a body, keep an intersection of 2 bodies or \_\_\_\_\_.
  - a) Add material to a body
  - b) Round the intersection of 2 bodies
  - c) Make an offset impression of a body
  - d) Convert a body to a surface

## Setups - Milling

1. The defined origin in the CNC software for a part must match that used on the drawing machine.
  - a) TRUE
  - b) FALSE

## 2D Milling Toolpaths

1. To avoid plunging into a part on a contour toolpath, you should:
  - a) Enter in from outside the stock
  - b) Gently ramp in using CNC parameters
  - c) Use an endmill that is capable of plunging
  - d) All of the above
  
2. If the tool chosen to program a toolpath has been resharpenered, the toolpath can be corrected by?
  - a) Updating the tool diameter
  - b) Using "Wear" in the control
  - c) Offsetting the geometry the appropriate amount
  - d) All the above

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3. It is possible to have a Contour toolpath with just a lead out but no lead in?
  - a) TRUE
  - b) FALSE
  
4. Peck drill is NOT a valid drill toolpath cycle operation?
  - a) TRUE
  - b) FALSE
  
5. When activated, what will Tip Comp do?
  - a) Tells the Tool to compensate to the right
  - b) Tells the Tool to drill past the final depth to compensate for tool tip
  - c) Tells the Tool to compensate to the left
  - d) Tells the Tool to compensate the tip to the top of the work piece
  
6. When activated, Depth Cuts will allow you to configure the number of depth cuts the tool will take.
  - a) TRUE
  - b) FALSE
  
7. When activated the Break Through feature will ensure the tool cuts all the way through the bottom of the part.
  - a) TRUE
  - b) FALSE
  
8. What is the function of Multi passes?
  - a) Creates extra depth moves.
  - b) Creates extra contour moves in the XY plane.
  - c) Creates extra pocket moves in the XY plane.
  - d) Creates extra tool motions in High Speed Toolpaths.
  
9. If you have a Hole that requires a Counterbore in your programming, you should use:
  - a) Drilling
  - b) Slotting
  - c) Threading
  - d) Pocketing

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10. Work Coordinate systems can only be used in Lathe programs.
- TRUE
  - FALSE
11. When you are creating your toolpath and it requires coolant due to dense material:
- You should not worry about programming the coolant code in because you can turn it on or off at the machine.
  - You should make sure that it is the correct type of Coolant flow and be sure to have the machinist be informed about the coolant.
  - Try to adjust the program so it does not need any coolant.
  - Make a change in the material so you don't have to use any coolant.
12. A \_\_\_\_\_ is needed to turn the graphical toolpaths into useable gcode for the CNC machine.
- G code editor
  - Any text editor
  - Simulation program
  - Post processor
13. What is the preferred cutting method when programming for a mill?
- Conventional
  - Climb
14. When programming a CNC toolpath you must have the correct \_\_\_\_\_ \_\_\_\_\_ in order to convert the toolpath into code your machine can read?
- Post Processor
  - Service Pack
  - Internet Connection
  - Clock Speed
15. Why would you use Tabs during an external contour operation?
- No such option as Tabs
  - To leave stock so a part is still held in a vise
  - To find additional toolpath features
  - To indent the outside profile of a part

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16. What do the following terms represent? Counterbore, Chip Breaking, Peck, Tap
- a) Drill Cycles
  - b) Tool Types
  - c) Lead-in motion
  - d) Hole Types
17. True/False: G code cannot be edited after creation.
- a) TRUE
  - b) FALSE
18. True/False: A machine operator needs to know what tools are used in a program.
- a) TRUE
  - b) FALSE

## CAM Milling Sample Test Answer Key

### Process Planning

- |      |      |       |
|------|------|-------|
| 1. C | 5. A | 9. A  |
| 2. A | 6. D | 10. C |
| 3. B | 7. A | 11. B |
| 4. C | 8. C | 12. A |

### 2D Sketching and 3D Modeling

1. C
2. A

### Setups- Milling

1. A

### 2D Milling Toolpaths

- |      |       |       |
|------|-------|-------|
| 1. D | 8. B  | 15. B |
| 2. D | 9. A  | 16. A |
| 3. A | 10. B | 17. B |
| 4. B | 11. B | 18. A |
| 5. B | 12. D |       |
| 6. A | 13. B |       |
| 7. A | 14. A |       |