**Section 1: Raspberry Pi OS Installation & Initial Configuration**

**MCQs**

1. **Which software tool is used to write the Raspberry Pi OS image to a microSD card?**  
   A. Etcher  
   B. Raspberry Pi Imager  
   C. Rufus  
   D. Win32 Disk Imager  
   **Answer:** B. Raspberry Pi Imager
2. **When using Raspberry Pi Imager, which setting would you adjust to configure WiFi credentials before booting for the first time?**  
   A. Localisation settings  
   B. OS Customisation settings  
   C. Advanced display settings  
   D. Timezone settings  
   **Answer:** B. OS Customisation settings

**Short Answer**

1. **In the Raspberry Pi Imager’s advanced settings, name two items you can configure before flashing the microSD card.**  
   **Answer:**
   * Hostname of the Raspberry Pi
   * Username and password
   * WiFi credentials (SSID and password)
   * SSH enabling
   * Locale settings (timezone, keyboard layout)
2. **What is the command to update the list of available packages on a Raspberry Pi running Raspberry Pi OS?**  
   **Answer:**

sql

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sudo apt update

1. **What is the command to upgrade all currently installed packages on a Raspberry Pi?**  
   **Answer:**

nginx

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sudo apt upgrade

**Section 2: Hardware Setup & Basic Configuration**

**MCQs**

1. **Which of the following components is not strictly required to get the Raspberry Pi 400 up and running with a webcam?**  
   A. MicroSD card with Raspberry Pi OS  
   B. Power supply  
   C. Ethernet cable  
   D. USB webcam  
   **Answer:** C. Ethernet cable (WiFi is used instead.)
2. **To enable VNC on a headless Raspberry Pi via SSH, which tool do you typically use?**  
   A. raspi-config  
   B. config.txt  
   C. sudo raspi-config  
   D. /boot/cmdline.txt  
   **Answer:** C. sudo raspi-config

**Short Answer**

1. **Which command would you run to edit the network configuration file (dhcpcd.conf) on Raspberry Pi OS?**  
   **Answer:**

bash

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sudo nano /etc/dhcpcd.conf

1. **Explain why assigning a static IP to your Raspberry Pi can be useful in a lab environment.**  
   **Answer:**  
   Assigning a static IP ensures the Raspberry Pi always has the same IP address, making it easier to connect via SSH or VNC without having to repeatedly look up or update the IP address.

**Section 3: Using SSH and VNC**

**MCQs**

1. **Which of the following protocols is used by VNC to provide a graphical desktop over the network?**  
   A. RDP (Remote Desktop Protocol)  
   B. RFB (Remote Framebuffer Protocol)  
   C. SSH (Secure Shell)  
   D. FTP (File Transfer Protocol)  
   **Answer:** B. RFB (Remote Framebuffer Protocol)

**Short Answer**

1. **What is the default port used by VNC on a Raspberry Pi?**  
   **Answer:** Port 5900
2. **State one way to find your Raspberry Pi’s IP address on a local network if you do not have direct access to its desktop.**  
   **Answer:**
   * Check the device list on your router or mobile hotspot
   * Use the arp -a command on your local machine
   * Use network scanning tools (e.g., nmap)

**Section 4: Webcam Setup & Testing**

**MCQs**

1. **Which command-line tool is typically used to capture a still image on the Raspberry Pi with a USB webcam?**  
   A. motion  
   B. fswebcam  
   C. raspistill  
   D. gstreamer  
   **Answer:** B. fswebcam
2. **What is the Linux subsystem or driver model used for webcams on Raspberry Pi OS?**  
   A. ALSA  
   B. Video4Linux2 (v4l2)  
   C. GStreamer  
   D. MESA  
   **Answer:** B. Video4Linux2 (v4l2)

**Short Answer**

1. **Write the exact command to capture a 1280×720 image named image.jpg using fswebcam without displaying the banner text.**  
   **Answer:**

nginx

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fswebcam -r 1280x720 --no-banner image.jpg

1. **Which command is used to list all USB devices connected to the Raspberry Pi?**  
   **Answer:**

nginx

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lsusb

**Section 5: Audio Input & arecord**

**MCQs**

1. **Which command can be used to record audio on a Raspberry Pi from a recognized microphone?**  
   A. aplay  
   B. ffmpeg  
   C. arecord  
   D. sox  
   **Answer:** C. arecord
2. **If your webcam’s microphone is recognized as card 2, device 0, which of the following commands records a 10-second clip?**  
   A. arecord -D plughw:0,2 -d 10 test.wav  
   B. arecord -D plughw:2,0 -d 10 test.wav  
   C. arecord -D hw:2,0 -d 10 test.wav  
   D. arecord -d 10 test.wav  
   **Answer:** B. arecord -D plughw:2,0 -d 10 test.wav

**Short Answer**

1. **What is the command to play back the recorded audio file test.wav?**  
   **Answer:**

nginx

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aplay test.wav

1. **If you cannot hear any audio on playback, mention one troubleshooting step you might try.**  
   **Answer:**
   * Check alsamixer to ensure the volume isn’t muted.
   * Ensure the correct audio output is selected (e.g., HDMI or headphone jack).
   * Verify that the proper audio device is in use.

**Section 6: Video Recording with ffmpeg**

**MCQs**

1. **Which flag specifies the video input format when using ffmpeg on a Raspberry Pi with a USB webcam?**  
   A. -i  
   B. -r  
   C. -video\_size  
   D. -f  
   **Answer:** D. -f
2. **In the command below, what does the -framerate 25 parameter control?**

bash

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ffmpeg -f v4l2 -framerate 25 -video\_size 640x480 -i /dev/video0 output.mp4

A. The bitrate  
B. The resolution  
C. The capture frames per second  
D. The audio sampling rate  
**Answer:** C. The capture frames per second

**Short Answer**

1. **Write a sample ffmpeg command to record a 30-second video clip from /dev/video0 at 800×600 resolution into a file called myvideo.mp4.**  
   **Answer:**

bash

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ffmpeg -f v4l2 -t 30 -video\_size 800x600 -i /dev/video0 myvideo.mp4

*(Optionally add -framerate 25 if needed.)*

**Section 7: Virtual Environments & Python**

**MCQs**

1. **Which command is used to create a Python virtual environment named myenv?**  
   A. python3 -m venv myenv  
   B. virtualenv myenv  
   C. mkvenv myenv  
   D. pip install myenv  
   **Answer:** A. python3 -m venv myenv
2. **After creating a virtual environment, which command do you use to activate it on a Raspberry Pi OS (bash shell)?**  
   A. enable myenv  
   B. bash myenv  
   C. source myenv/bin/activate  
   D. activate myenv  
   **Answer:** C. source myenv/bin/activate

**Short Answer**

1. **Why is it recommended to use a Python virtual environment when installing packages like opencv-python?**  
   **Answer:**  
   Using a virtual environment prevents version conflicts by isolating package installations from the system-wide Python packages, keeping your global environment clean.

**Section 8: Motion Detection & OpenCV Basics (Advanced/Optional)**

**MCQs**

1. **Which OpenCV function is commonly used to convert a frame to grayscale?**  
   A. cv2.absdiff  
   B. cv2.cvtColor  
   C. cv2.threshold  
   D. cv2.findContours  
   **Answer:** B. cv2.cvtColor
2. **In a simple motion detection script using OpenCV, which function is used to find the outlines of detected shapes or movements?**  
   A. cv2.GaussianBlur  
   B. cv2.dilate  
   C. cv2.absdiff  
   D. cv2.findContours  
   **Answer:** D. cv2.findContours

**Short Answer**

1. **Briefly explain what the following line of code does in a motion detection script:**

python

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frame\_delta = cv2.absdiff(gray1, gray2)

**Answer:**  
It calculates the absolute difference between two grayscale frames (gray1 and gray2), highlighting the regions where changes (i.e., motion) occur.

1. **What is one practical use of a Python-based motion detection system on a Raspberry Pi?**  
   **Answer:**  
   It can be used for home security or surveillance, wildlife monitoring, or triggering automated tasks when movement is detected.

**Section 9: General Troubleshooting & Best Practices**

**MCQs**

1. **If the webcam video is lagging or dropping frames, which of the following might improve performance?**  
   A. Increase resolution to 4K  
   B. Lower the frame rate  
   C. Use a lower resolution  
   D. Switch to the composite video output  
   **Answer:** C. Use a lower resolution

**Short Answer**

1. **Name two commands or methods you can use to check the CPU and memory usage on your Raspberry Pi when troubleshooting performance issues.**  
   **Answer:**
   * top or htop
   * free -h
   * (Additionally, vcgencmd measure\_temp can be used for temperature monitoring)
2. **Why might you need to install haveged on a headless Raspberry Pi when enabling VNC?**  
   **Answer:**  
   haveged supplies additional entropy, which is essential for secure operations (including SSH/VNC sessions) when there is little keyboard or mouse activity, thus preventing entropy starvation.

**Section 10: Additional Open-Ended/Discussion Questions**

1. **Explain how to configure the Raspberry Pi 400 so that it automatically logs in upon boot and starts the desktop environment (useful for kiosk-like setups).**  
   *Answer will vary. Consider discussing modifications in the Raspberry Pi configuration files or using raspi-config settings to auto-login and start the desktop.*
2. **Discuss how changing contour area thresholds in a motion detection script affects sensitivity and false positives.**  
   *Answer will vary. Explain that adjusting the thresholds can either filter out small, insignificant movements or, if set too low, trigger false alarms due to minor changes or noise.*
3. **Propose a simple Python script flow that captures an image every 30 seconds and uploads it to a cloud service.**  
   *Answer will vary. A sample response might include using a loop with time.sleep(30), capturing the image with OpenCV or fswebcam, and then using an API (e.g., AWS S3, Google Cloud Storage) to upload the file.*