



UNIVERSIDAD NACIONAL AUTÓNOMA DE MÉXICO

FACULTAD DE INGENIERÍA

DIVISIÓN DE INGENIERÍA ELÉCTRICA

INGENIERÍA EN COMPUTACIÓN

LABORATORIO DE COMPUTACIÓN GRÁFICA e
INTERACCIÓN HUMANO COMPUTADORA



REPORTE DE PRÁCTICA N° 03

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GRUPO DE LABORATORIO: 03

GRUPO DE TEORÍA: 04

SEMESTRE 2026-1

FECHA DE ENTREGA LÍMITE: 07 de septiembre del 2025

CALIFICACIÓN: _____

REPORTE DE PRÁCTICA:

1.- Ejecución de los ejercicios que se dejaron, comentar cada uno y capturas de pantalla de bloques de código generados y de ejecución del programa.

Modificaciones del código.

```
};  
vector<GLfloat> piramidecuadrangular_vertices = {  
    0.5f,-0.5f,0.5f,  
    0.5f,-0.5f,-0.5f,  
    -0.5f,-0.5f,-0.5f,  
    -0.5f,-0.5f,0.5f,  
    0.0f,0.5f,0.0f,  
};
```

```
402 //BASE NEGRA  
403 glm::mat4 model;  
404 glm::vec3 color;  
405  
406 model = glm::mat4(1.0f);  
407 model = glm::translate(model, glm::vec3(0.0f, 0.0f, -4.0f));  
408 glUniformMatrix4fv(uniformModel, 1, GL_FALSE, glm::value_ptr(model));  
409 color = glm::vec3(0.0f, 0.0f, 0.0f);  
410 glUniform3fv(uniformColor, 1, glm::value_ptr(color));  
411 meshList[6]->RenderMesh();  
412  
413 //COLOR ROJO  
414 model = glm::mat4(1.0);  
415 model = glm::translate(model, glm::vec3(0.0f, 0.9f, -4.42f));  
416 model = glm::rotate(model, glm::radians(-5.0f), glm::vec3(1.0f, 0.0f, 0.0f));  
417 model = glm::scale(model, glm::vec3(0.5f));  
418 glUniformMatrix4fv(uniformModel, 1, GL_FALSE, glm::value_ptr(model));  
419 color = glm::vec3(1.0f, 0.0f, 0.0f);  
420 glUniform3fv(uniformColor, 1, glm::value_ptr(color));  
421 meshList[1]->RenderMesh();  
422  
423 model = glm::mat4(1.0);  
424 model = glm::translate(model, glm::vec3(-0.37f, 0.10f, -4.2f));  
425 model = glm::scale(model, glm::vec3(0.5f));  
426 glUniformMatrix4fv(uniformModel, 1, GL_FALSE, glm::value_ptr(model));  
427 glUniform3fv(uniformColor, 1, glm::value_ptr(color));  
428 meshList[1]->RenderMesh();
```

```

430     model = glm::mat4(1.0);
431     model = glm::translate(model, glm::vec3(0.0f, 0.18f, -4.22f));
432     model = glm::rotate(model, glm::radians(180.0f), glm::vec3(0.0f, 0.0f, 1.0f));
433     model = glm::rotate(model, glm::radians(25.0f), glm::vec3(1.0f, 0.0f, 0.0f));
434     model = glm::scale(model, glm::vec3(0.5f));
435     glUniformMatrix4fv(uniformModel, 1, GL_FALSE, glm::value_ptr(model));
436     glUniform3fv(uniformColor, 1, glm::value_ptr(color));
437     meshList[1] -> RenderMesh();
438
439     model = glm::mat4(1.0);
440     model = glm::translate(model, glm::vec3(0.37f, 0.10f, -4.2f));
441     model = glm::scale(model, glm::vec3(0.5f));
442     glUniformMatrix4fv(uniformModel, 1, GL_FALSE, glm::value_ptr(model));
443     glUniform3fv(uniformColor, 1, glm::value_ptr(color));
444     meshList[1] -> RenderMesh();
445
446     model = glm::mat4(1.0);
447     model = glm::translate(model, glm::vec3(-0.78f, -0.68f, -4.01f));
448     model = glm::scale(model, glm::vec3(0.5f));
449     glUniformMatrix4fv(uniformModel, 1, GL_FALSE, glm::value_ptr(model));
450     glUniform3fv(uniformColor, 1, glm::value_ptr(color));
451     meshList[1] -> RenderMesh();
452
453     model = glm::mat4(1.0);
454     model = glm::translate(model, glm::vec3(0.0f, -0.68f, -4.01f));
455     model = glm::scale(model, glm::vec3(0.5f));
456     glUniformMatrix4fv(uniformModel, 1, GL_FALSE, glm::value_ptr(model));
457     glUniform3fv(uniformColor, 1, glm::value_ptr(color));
458     meshList[1] -> RenderMesh();
459
460     model = glm::mat4(1.0);
461     model = glm::translate(model, glm::vec3(0.78f, -0.68f, -4.01f));
462     model = glm::scale(model, glm::vec3(0.5f));
463     glUniformMatrix4fv(uniformModel, 1, GL_FALSE, glm::value_ptr(model));
464     glUniform3fv(uniformColor, 1, glm::value_ptr(color));
465     meshList[1] -> RenderMesh();
466

```

```

467     model = glm::mat4(1.0);
468     model = glm::translate(model, glm::vec3(0.39f, -0.6f, -4.04f));
469     model = glm::rotate(model, glm::radians(180.0f), glm::vec3(0.0f, 0.0f, 1.0f));
470     model = glm::rotate(model, glm::radians(25.0f), glm::vec3(1.0f, 0.0f, 0.0f));
471     model = glm::scale(model, glm::vec3(0.5f));
472     glUniformMatrix4fv(uniformModel, 1, GL_FALSE, glm::value_ptr(model));
473     glUniform3fv(uniformColor, 1, glm::value_ptr(color));
474     meshList[1] -> RenderMesh();
475
476     model = glm::mat4(1.0);
477     model = glm::translate(model, glm::vec3(-0.39f, -0.6f, -4.04f));
478     model = glm::rotate(model, glm::radians(180.0f), glm::vec3(0.0f, 0.0f, 1.0f));
479     model = glm::rotate(model, glm::radians(25.0f), glm::vec3(1.0f, 0.0f, 0.0f));
480     model = glm::scale(model, glm::vec3(0.5f));
481     glUniformMatrix4fv(uniformModel, 1, GL_FALSE, glm::value_ptr(model));
482     glUniform3fv(uniformColor, 1, glm::value_ptr(color));
483     meshList[1] -> RenderMesh();
484
485     //COLOR AZUL
486     model = glm::mat4(1.0);
487     model = glm::translate(model, glm::vec3(0.032f, 0.9f, -4.88f));
488     model = glm::rotate(model, glm::radians(125.0f), glm::vec3(0.0f, 0.7f, 0.0f));
489     model = glm::rotate(model, glm::radians(5.0f), glm::vec3(0.0f, 0.0f, 1.0f));
490     model = glm::scale(model, glm::vec3(0.5f));
491     glUniformMatrix4fv(uniformModel, 1, GL_FALSE, glm::value_ptr(model));
492     color = glm::vec3(0.0f, 0.0f, 1.0f);
493     glUniform3fv(uniformColor, 1, glm::value_ptr(color));
494     meshList[1] -> RenderMesh();
495
496     model = glm::mat4(1.0);
497     model = glm::translate(model, glm::vec3(-0.07f, 0.1f, -5.34f));
498     model = glm::rotate(model, glm::radians(125.0f), glm::vec3(0.0f, 1.0f, 0.0f));
499     model = glm::rotate(model, glm::radians(2.0f), glm::vec3(0.0f, 0.0f, 1.0f));
500     model = glm::rotate(model, glm::radians(0.5f), glm::vec3(1.0f, 0.0f, 0.0f));
501     model = glm::scale(model, glm::vec3(0.5f));
502     glUniformMatrix4fv(uniformModel, 1, GL_FALSE, glm::value_ptr(model));
503     glUniform3fv(uniformColor, 1, glm::value_ptr(color));
504     meshList[1] -> RenderMesh();
505

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506     model = glm::mat4(1.0);
507     model = glm::translate(model, glm::vec3(-0.3f, 0.1f, -5.05f));
508     model = glm::scale(model, glm::vec3(0.5f));
509     model = glm::rotate(model, glm::radians(180.0f), glm::vec3(1.0f, 0.0f, 0.0f));
510     model = glm::rotate(model, glm::radians(59.0f), glm::vec3(0.0f, 1.0f, 0.0f));
511     model = glm::rotate(model, glm::radians(42.0f), glm::vec3(0.0f, 0.0f, 1.0f));
512     model = glm::rotate(model, glm::radians(-21.0f), glm::vec3(1.0f, 0.0f, 0.0f));
513     glUniformMatrix4fv(uniformModel, 1, GL_FALSE, glm::value_ptr(model));
514     glUniform3fv(uniformColor, 1, glm::value_ptr(color));
515     meshList[1]->RenderMesh();
516
517     model = glm::mat4(1.0);
518     model = glm::translate(model, glm::vec3(-0.37f, 0.1f, -4.67f));
519     model = glm::rotate(model, glm::radians(125.0f), glm::vec3(0.0f, 1.0f, 0.0f));
520     model = glm::rotate(model, glm::radians(2.0f), glm::vec3(0.0f, 0.0f, 1.0f));
521     model = glm::rotate(model, glm::radians(0.5f), glm::vec3(1.0f, 0.0f, 0.0f));
522     model = glm::scale(model, glm::vec3(0.5f));
523     glUniformMatrix4fv(uniformModel, 1, GL_FALSE, glm::value_ptr(model));
524     glUniform3fv(uniformColor, 1, glm::value_ptr(color));
525     meshList[1]->RenderMesh();
526
527     model = glm::mat4(1.0);
528     model = glm::translate(model, glm::vec3(-0.151f, -0.68f, -5.81f));
529     model = glm::rotate(model, glm::radians(125.0f), glm::vec3(0.0f, 1.0f, 0.0f));
530     model = glm::rotate(model, glm::radians(2.0f), glm::vec3(0.0f, 0.0f, 1.0f));
531     model = glm::rotate(model, glm::radians(0.5f), glm::vec3(1.0f, 0.0f, 0.0f));
532     model = glm::scale(model, glm::vec3(0.5f));
533     glUniformMatrix4fv(uniformModel, 1, GL_FALSE, glm::value_ptr(model));
534     glUniform3fv(uniformColor, 1, glm::value_ptr(color));
535     meshList[1]->RenderMesh();
536
537     model = glm::mat4(1.0);
538     model = glm::translate(model, glm::vec3(-0.3f, -0.68f, -5.56f));
539     model = glm::scale(model, glm::vec3(0.5f));
540     model = glm::rotate(model, glm::radians(180.0f), glm::vec3(1.0f, 0.0f, 0.0f));
541     model = glm::rotate(model, glm::radians(58.0f), glm::vec3(0.0f, 1.0f, 0.0f));
542     model = glm::rotate(model, glm::radians(42.0f), glm::vec3(0.0f, 0.0f, 1.0f));
543     model = glm::rotate(model, glm::radians(-21.0f), glm::vec3(1.0f, 0.0f, 0.0f));
544     glUniformMatrix4fv(uniformModel, 1, GL_FALSE, glm::value_ptr(model));
545     glUniform3fv(uniformColor, 1, glm::value_ptr(color));
546     meshList[1]->RenderMesh();
547

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548     model = glm::mat4(1.0);
549     model = glm::translate(model, glm::vec3(-0.46f, -0.68f, -5.15f));
550     model = glm::rotate(model, glm::radians(125.0f), glm::vec3(0.0f, 1.0f, 0.0f));
551     model = glm::rotate(model, glm::radians(2.0f), glm::vec3(0.0f, 0.0f, 1.0f));
552     model = glm::rotate(model, glm::radians(0.5f), glm::vec3(1.0f, 0.0f, 0.0f));
553     model = glm::scale(model, glm::vec3(0.5f));
554     glUniformMatrix4fv(uniformModel, 1, GL_FALSE, glm::value_ptr(model));
555     glUniform3fv(uniformColor, 1, glm::value_ptr(color));
556     meshList[1]->RenderMesh();
557
558     model = glm::mat4(1.0);
559     model = glm::translate(model, glm::vec3(-0.7f, -0.7f, -4.8f));
560     model = glm::scale(model, glm::vec3(0.5f));
561     model = glm::rotate(model, glm::radians(180.0f), glm::vec3(1.0f, 0.0f, 0.0f));
562     model = glm::rotate(model, glm::radians(59.0f), glm::vec3(0.0f, 1.0f, 0.0f));
563     model = glm::rotate(model, glm::radians(42.0f), glm::vec3(0.0f, 0.0f, 1.0f));
564     model = glm::rotate(model, glm::radians(-21.0f), glm::vec3(1.0f, 0.0f, 0.0f));
565     glUniformMatrix4fv(uniformModel, 1, GL_FALSE, glm::value_ptr(model));
566     glUniform3fv(uniformColor, 1, glm::value_ptr(color));
567     meshList[1]->RenderMesh();
568
569     model = glm::mat4(1.0);
570     model = glm::translate(model, glm::vec3(-0.77f, -0.70f, -4.45f));
571     model = glm::rotate(model, glm::radians(125.0f), glm::vec3(0.0f, 1.0f, 0.0f));
572     model = glm::rotate(model, glm::radians(4.0f), glm::vec3(0.0f, 0.0f, 1.0f));
573     model = glm::rotate(model, glm::radians(1.0f), glm::vec3(1.0f, 0.0f, 0.0f));
574     model = glm::scale(model, glm::vec3(0.5f));
575     glUniformMatrix4fv(uniformModel, 1, GL_FALSE, glm::value_ptr(model));
576     glUniform3fv(uniformColor, 1, glm::value_ptr(color));
577     meshList[1]->RenderMesh();
578
579     //COLOR VERDE
580     model = glm::mat4(1.0);
581     model = glm::translate(model, glm::vec3(0.2f, 0.9f, -4.85f));
582     model = glm::rotate(model, glm::radians(125.0f), glm::vec3(0.0f, 0.7f, 0.0f));
583     model = glm::scale(model, glm::vec3(0.5f));
584     glUniformMatrix4fv(uniformModel, 1, GL_FALSE, glm::value_ptr(model));
585     color = glm::vec3(0.0f, 1.0f, 0.0f);
586     glUniform3fv(uniformColor, 1, glm::value_ptr(color));
587     meshList[1]->RenderMesh();

```

```

579 //COLOR VERDE
580 model = glm::mat4(1.0);
581 model = glm::translate(model, glm::vec3(0.2f, 0.9f, -4.85f));
582 model = glm::rotate(model, glm::radians(125.0f), glm::vec3(0.0f, 0.7f, 0.0f));
583 model = glm::scale(model, glm::vec3(0.5f));
584 glUniformMatrix4fv(uniformModel, 1, GL_FALSE, glm::value_ptr(model));
585 color = glm::vec3(0.0f, 1.0f, 0.0f);
586 glUniform3fv(uniformColor, 1, glm::value_ptr(color));
587 meshList[1]->RenderMesh();
588
589 model = glm::mat4(1.0);
590 model = glm::translate(model, glm::vec3(0.45f, 0.12f, -4.42f));
591 model = glm::scale(model, glm::vec3(0.5f));
592 glUniformMatrix4fv(uniformModel, 1, GL_FALSE, glm::value_ptr(model));
593 glUniform3fv(uniformColor, 1, glm::value_ptr(color));
594 meshList[1]->RenderMesh();
595
596 model = glm::mat4(1.0);
597 model = glm::translate(model, glm::vec3(0.03f, 0.15f, -5.09f));
598 model = glm::scale(model, glm::vec3(0.5f));
599 glUniformMatrix4fv(uniformModel, 1, GL_FALSE, glm::value_ptr(model));
600 glUniform3fv(uniformColor, 1, glm::value_ptr(color));
601 meshList[1]->RenderMesh();
602
603 model = glm::mat4(1.0);
604 model = glm::translate(model, glm::vec3(0.07f, -0.69f, -5.77f));
605 model = glm::rotate(model, glm::radians(125.0f), glm::vec3(0.0f, 0.7f, 0.0f));
606 model = glm::scale(model, glm::vec3(0.5f));
607 glUniformMatrix4fv(uniformModel, 1, GL_FALSE, glm::value_ptr(model));
608 glUniform3fv(uniformColor, 1, glm::value_ptr(color));
609 meshList[1]->RenderMesh();
610
611 model = glm::mat4(1.0);
612 model = glm::translate(model, glm::vec3(0.4f, -0.66f, -4.87f));
613 model = glm::scale(model, glm::vec3(0.5f));
614 glUniformMatrix4fv(uniformModel, 1, GL_FALSE, glm::value_ptr(model));
615 glUniform3fv(uniformColor, 1, glm::value_ptr(color));
616 meshList[1]->RenderMesh();
617

```

```

618 model = glm::mat4(1.0);
619 model = glm::translate(model, glm::vec3(0.8f, -0.66f, -4.22f));
620 model = glm::scale(model, glm::vec3(0.5f));
621 glUniformMatrix4fv(uniformModel, 1, GL_FALSE, glm::value_ptr(model));
622 glUniform3fv(uniformColor, 1, glm::value_ptr(color));
623 meshList[1]->RenderMesh();
624
625 model = glm::mat4(1.0);
626 model = glm::translate(model, glm::vec3(0.8f, -0.6f, -4.83f));
627 model = glm::rotate(model, glm::radians(125.0f), glm::vec3(0.0f, 0.7f, 0.0f));
628 model = glm::rotate(model, glm::radians(-25.0f), glm::vec3(1.0f, 0.0f, 0.0f));
629 model = glm::rotate(model, glm::radians(180.0f), glm::vec3(0.0f, 0.0f, 1.0f));
630 model = glm::scale(model, glm::vec3(0.5f));
631 glUniformMatrix4fv(uniformModel, 1, GL_FALSE, glm::value_ptr(model));
632 glUniform3fv(uniformColor, 1, glm::value_ptr(color));
633 meshList[1]->RenderMesh();
634
635 model = glm::mat4(1.0);
636 model = glm::translate(model, glm::vec3(0.3f, -0.6f, -5.45f));
637 model = glm::rotate(model, glm::radians(125.0f), glm::vec3(0.0f, 0.7f, 0.0f));
638 model = glm::rotate(model, glm::radians(-25.0f), glm::vec3(1.0f, 0.0f, 0.0f));
639 model = glm::rotate(model, glm::radians(180.0f), glm::vec3(0.0f, 0.0f, 1.0f));
640 model = glm::scale(model, glm::vec3(0.5f));
641 glUniformMatrix4fv(uniformModel, 1, GL_FALSE, glm::value_ptr(model));
642 glUniform3fv(uniformColor, 1, glm::value_ptr(color));
643 meshList[1]->RenderMesh();
644
645 model = glm::mat4(1.0);
646 model = glm::translate(model, glm::vec3(0.3f, 0.19f, -5.0f));
647 model = glm::rotate(model, glm::radians(125.0f), glm::vec3(0.0f, 0.7f, 0.0f));
648 model = glm::rotate(model, glm::radians(-27.0f), glm::vec3(1.0f, 0.0f, 0.0f));
649 model = glm::rotate(model, glm::radians(180.0f), glm::vec3(0.0f, 0.0f, 1.0f));
650 model = glm::scale(model, glm::vec3(0.5f));
651 glUniformMatrix4fv(uniformModel, 1, GL_FALSE, glm::value_ptr(model));
652 glUniform3fv(uniformColor, 1, glm::value_ptr(color));
653 meshList[1]->RenderMesh();
654

```



```

655 //COLOR AMARILLO
656 model = glm::mat4(1.0);
657 model = glm::translate(model, glm::vec3(0.7f, -0.8f, -4.12f));
658 model = glm::rotate(model, glm::radians(-5.0f), glm::vec3(1.0f, 0.0f, 0.0f));
659 model = glm::scale(model, glm::vec3(0.5f));
660 glUniformMatrix4fv(uniformModel, 1, GL_FALSE, glm::value_ptr(model));
661 color = glm::vec3(1.0f, 1.0f, 0.0f);
662 glUniform3fv(uniformColor, 1, glm::value_ptr(color));
663 meshList[1] -> RenderMesh();
664
665 model = glm::mat4(1.0);
666 model = glm::translate(model, glm::vec3(-0.85f, -0.8f, -4.12f));
667 model = glm::rotate(model, glm::radians(-5.0f), glm::vec3(1.0f, 0.0f, 0.0f));
668 model = glm::scale(model, glm::vec3(0.5f));
669 glUniformMatrix4fv(uniformModel, 1, GL_FALSE, glm::value_ptr(model));
670 glUniform3fv(uniformColor, 1, glm::value_ptr(color));
671 meshList[1] -> RenderMesh();
672
673 model = glm::mat4(1.0);
674 model = glm::translate(model, glm::vec3(-0.097f, -0.8f, -4.12f));
675 model = glm::rotate(model, glm::radians(-5.0f), glm::vec3(1.0f, 0.0f, 0.0f));
676 model = glm::scale(model, glm::vec3(0.5f));
677 glUniformMatrix4fv(uniformModel, 1, GL_FALSE, glm::value_ptr(model));
678 glUniform3fv(uniformColor, 1, glm::value_ptr(color));
679 meshList[1] -> RenderMesh();
680
681 model = glm::mat4(1.0);
682 model = glm::translate(model, glm::vec3(-0.14f, -0.8f, -5.42f));
683 model = glm::rotate(model, glm::radians(-5.0f), glm::vec3(1.0f, 0.0f, 0.0f));
684 model = glm::scale(model, glm::vec3(0.5f));
685 glUniformMatrix4fv(uniformModel, 1, GL_FALSE, glm::value_ptr(model));
686 glUniform3fv(uniformColor, 1, glm::value_ptr(color));
687 meshList[1] -> RenderMesh();
688
689 model = glm::mat4(1.0);
690 model = glm::translate(model, glm::vec3(0.32f, -0.8f, -4.75f));
691 model = glm::rotate(model, glm::radians(-5.0f), glm::vec3(1.0f, 0.0f, 0.0f));
692 model = glm::scale(model, glm::vec3(0.5f));
693 glUniformMatrix4fv(uniformModel, 1, GL_FALSE, glm::value_ptr(model));
694 glUniform3fv(uniformColor, 1, glm::value_ptr(color));
695 meshList[1] -> RenderMesh();

```

```

696
697 model = glm::mat4(1.0);
698 model = glm::translate(model, glm::vec3(-0.49f, -0.8f, -4.75f));
699 model = glm::rotate(model, glm::radians(-5.0f), glm::vec3(1.0f, 0.0f, 0.0f));
700 model = glm::scale(model, glm::vec3(0.5f));
701 glUniformMatrix4fv(uniformModel, 1, GL_FALSE, glm::value_ptr(model));
702 glUniform3fv(uniformColor, 1, glm::value_ptr(color));
703 meshList[1] -> RenderMesh();
704
705 model = glm::mat4(1.0);
706 model = glm::translate(model, glm::vec3(-0.49f, -0.85f, -4.63f));
707 model = glm::rotate(model, glm::radians(180.0f), glm::vec3(0.0f, 1.0f, 0.0f));
708 model = glm::scale(model, glm::vec3(0.5f));
709 glUniformMatrix4fv(uniformModel, 1, GL_FALSE, glm::value_ptr(model));
710 glUniform3fv(uniformColor, 1, glm::value_ptr(color));
711 meshList[1] -> RenderMesh();
712
713 model = glm::mat4(1.0);
714 model = glm::translate(model, glm::vec3(-0.13f, -0.85f, -5.32f));
715 model = glm::rotate(model, glm::radians(180.0f), glm::vec3(0.0f, 1.0f, 0.0f));
716 model = glm::scale(model, glm::vec3(0.5f));
717 glUniformMatrix4fv(uniformModel, 1, GL_FALSE, glm::value_ptr(model));
718 glUniform3fv(uniformColor, 1, glm::value_ptr(color));
719 meshList[1] -> RenderMesh();
720
721 model = glm::mat4(1.0);
722 model = glm::translate(model, glm::vec3(0.26f, -0.85f, -4.61f));
723 model = glm::rotate(model, glm::radians(180.0f), glm::vec3(0.0f, 1.0f, 0.0f));
724 model = glm::scale(model, glm::vec3(0.5f));
725 glUniformMatrix4fv(uniformModel, 1, GL_FALSE, glm::value_ptr(model));
726 glUniform3fv(uniformColor, 1, glm::value_ptr(color));
727 meshList[1] -> RenderMesh();
728
729
730 glUseProgram(0);
731 mainWindow.swapBuffers();
732 }
733 return 0;
734 }

```

Lo que hice fue definir primero la geometría de una pirámide chica, que es la pieza básica. Ajusté los cuatro vértices para que la punta y la base tuvieran las proporciones correctas y luego esa malla la guardé en `meshList[1]`. Esa misma malla la reutilicé varias veces, sin volver a crear vértices, solo dibujándola varias veces con diferentes transformaciones.

Después construí una base negra grande que sirve como la estructura donde se acomodan todas las piezas. Esta base la guardé en `meshList[6]` y su función es dar el efecto visual de las separaciones oscuras, como las líneas negras que dividen las piezas en un rompecabezas real.

Para formar cada cara de la pirámide utilicé nueve instancias de la misma pirámide chica. La idea fue colocar cada pieza con transformaciones: usé traslaciones para moverlas a la posición correcta, rotaciones para orientarlas en ciertos huecos y escalas para ajustar su tamaño. De esa forma, se construye la cuadrícula de tres niveles: primero la punta en la parte superior, luego la segunda fila con tres piezas y finalmente la tercera fila con cinco piezas, algunas de ellas rotadas para que encajen bien en la figura.

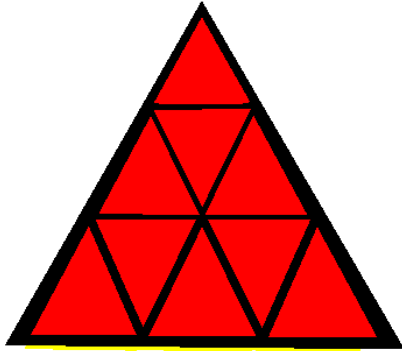
También asigné colores diferentes a cada grupo de piezas de una cara, cambiando el `uniform` del color en el `shader`. Así una cara completa se ve roja, otra azul, otra verde y otra amarilla. El color no está en los vértices, sino que se aplica justo antes de dibujar cada bloque de piezas.

Hacerlo de esta manera nos permite reutilizar una sola malla para todas las piezas, lo cual es mucho más eficiente y limpio que crear varias. La base negra y los pequeños desplazamientos aseguran que se noten las divisiones entre pirámides. Además, al tener todo armado con transformaciones es muy sencillo después animar las piezas, cambiar colores o modificar posiciones sin necesidad de tocar la geometría original. El resultado final es una pirámide rubik (`pyraminx`) con nueve piezas por cara, colores sólidos y las líneas de separación bien visibles.

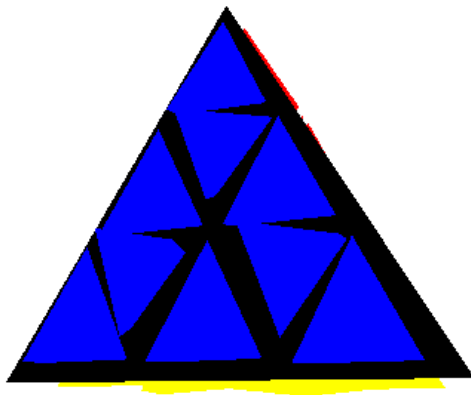
Ejecución

Varias caras

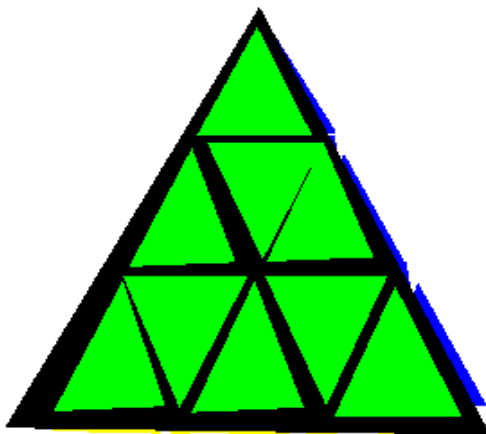
Rojo



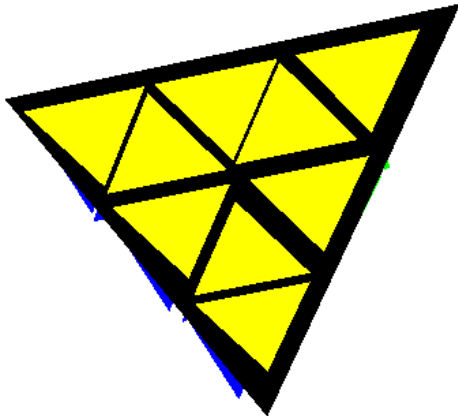
Azul



Verde



Amarillo



2.- Liste los problemas que tuvo a la hora de hacer estos ejercicios y si los resolvió explicar cómo fue, en caso de error adjuntar captura de pantalla

3.- Conclusión:

a. Los ejercicios del reporte: Complejidad, Explicación.

En general, esta práctica me pareció interesante pero también mucho más laboriosa que las anteriores. Lo que más se me complicó fue armar toda la pirámide completa, ya que tuve que definir primero la pirámide base y luego organizar todas las pirámides más pequeñas para que cada cara quedara bien formada. Fue un reto pensar en las posiciones, rotaciones y escalas necesarias para que las piezas encajaran correctamente y mantuvieran la forma del rompecabezas. Aunque al principio resultó difícil y un poco tardado, al final logré que cada cara quedara con sus nueve piezas y que los colores se distribuyeran como quería. Considero que fue un buen ejercicio porque me permitió practicar bastante el uso de transformaciones y entender cómo con una sola malla se pueden generar muchas figuras distintas.

b. Comentarios generales: Faltó explicar a detalle, ir más lento en alguna explicación, otros comentarios y sugerencias para mejorar desarrollo de la práctica

Ninguno

c. Conclusión

Me agradó desarrollar esta práctica porque me permitió aplicar lo aprendido de OpenGL en un reto más complejo. Aunque al principio se me complicó definir las pirámides pequeñas y organizar toda la estructura para que la figura completa tomara forma, con paciencia logré resolverlo y quedé satisfecho con el resultado.

Considero que fue un buen avance porque combiné el uso de transformaciones y colores para construir una pyraminx con cada cara diferenciada, lo cual hizo que el modelo final se viera mucho más completo y visualmente atractivo.

Bibliografía en formato APA