Final Exam

PROBLEM #1: (15 points from 34) (25 points from 54)

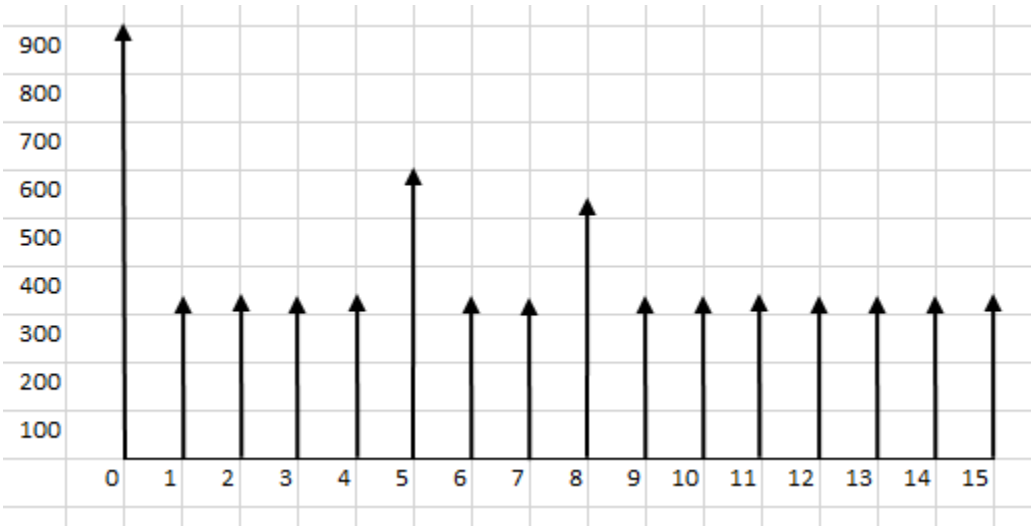
Income of a project over a 15-year period is given in the table below.

Year	End of Year Payment
0	900
1	320
2	320
3	320
4	320
5	600
6	320
7	320
8	520
9	320
10	320
11	320
12	320
13	320
14	320
15	320

For the interest rate of 7% compounded annually, plot the cash flow diagram and perform the following steps for the project:
1. Calculate the present worth of the project using formulas for factors.
2. Calculate the present worth of the project using tables for factors and compare with answer in in part 2. Explain the reason for difference, if any.
3. Calculate future worth of the project at the end of year 15 using tables.
4. Calculate future worth of the project at the end of year 10 using the calculated value in part 3.
5. Calculate the equivalent annual payment of the project over 15 years.

Solution:

Cash flow diagram is plotted below



1. Finding Present worth using formulas:

We have a number of payments in different years. We need to bring them to the present time (year 0). The first payment is already at year 0. The other payments are at different years. To find its present worth we need to use the formula (interest rate is 7%):

$$P = F\,(1+i)^{-n} = F\,(1.07)^{-n}$$

For example, for the payment in year 6 which is \$320, we will have:

$$P = 320\,(1.07)^{-6} = 320\,(0.666342) = \$213.23$$

The rest of the calculations are similar and presented in the table below with the overall result to be \$4,130.57.

I =	0.07

YR	Payment	$P = F (1+i)^{-N}$	Present Worth
0	900	1.000000	900.00
1	320	0.934579	299.07
2	320	0.873439	279.50
3	320	0.816298	261.22
4	320	0.762895	244.13
5	600	0.712986	427.79
6	320	0.666342	213.23
7	320	0.622750	199.28
8	520	0.582009	302.64
9	320	0.543934	174.06
10	320	0.508349	162.67
11	320	0.475093	152.03
12	320	0.444012	142.08
13	320	0.414964	132.79
14	320	0.387817	124.10
15	320	0.362446	115.98
			4130.57

2. Finding present worth of the project using tables

Using the factor values from the table we should get very close values. Because, values in the table are just rounded off after the fourth decimal. Find the (P/F, I, n) values from the table and calculate using P = F (P/F, I, n) calculate the present worth of each payment. In this case the overall result changed by only 7 cents.

I =	0.07

YR	Payment	(P/F, I, n)	Present Worth
0	900	1.0000	900.00
1	320	0.9346	299.07
2	320	0.8734	279.49
3	320	0.8163	261.22
4	320	0.7629	244.13
5	600	0.7130	427.80
6	320	0.6663	213.22
7	320	0.6227	199.26
8	520	0.5820	302.64
9	320	0.5439	174.05
10	320	0.5083	162.66
11	320	0.4751	152.03
12	320	0.4440	142.08
13	320	0.4150	132.80
14	320	0.3878	124.10
15	320	0.3624	115.97
			4130.50

3. Finding future worth of the project at the end of year 15 using tables

In calculating present worth finding n is simple. It is the year that the payment is occurred. For example, if payment occurred at the end of year 6, then n=6. For future worth you actually have to count. For example, if payment occurred at the end of year 10, and you wanted to calculate the future value at the end of year 15, then check to see how many years are between them:

year 10 set to 0
year 11 set to 1
year 12 set to 2
year 13 set to 3
year 14 set to 4
year 15 set to 5

Which make n=5 (or just use 15-10=5). So future worth of $320 from year 10 at year 15 is

F = P (F/P, I, n) = 320 (1.403) = $448.81

The calculations are provided below.

I =	0.07

YR	Payment	(F/P, I, n)	Present Worth
0	320	1.000	320.00
1	320	1.070	342.39
2	320	1.145	366.38
3	320	1.225	392.01
4	320	1.311	419.45
5	320	1.403	448.81
6	320	1.501	480.26
7	520	1.606	835.07
8	320	1.718	549.83
9	320	1.839	588.34
10	600	1.967	1180.41
11	320	2.105	673.54
12	320	2.252	720.72
13	320	2.410	771.08
14	320	2.579	825.17
15	900	2.759	2483.44
			11396.92

4. Finding future worth of the project at the end of year 10 using the calculated value in part 3.

We know that future worth of the project at the end of year 15 is $11396.92. We can use this value and use its present worth at the end of year 10. To do that it is enough to calculate:
P = F (P/F, 7%, 5) = $11,396.92 (0.7130) = $8,126.01
n=5 was calculated by either counting the years or by 15-10=5.

5. Finding the equivalent annual payment of the project over 15 years.

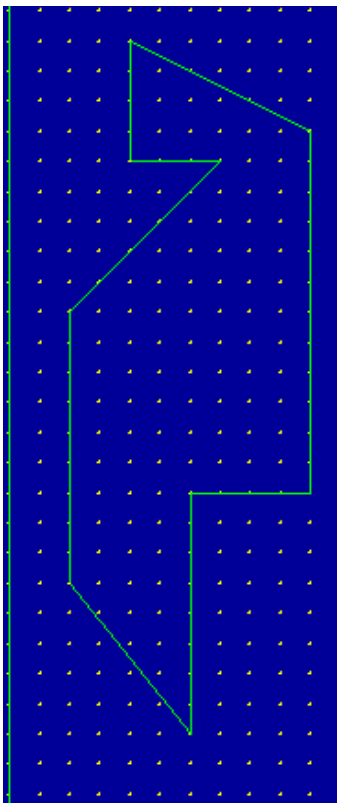
We can use either the value of the future worth of the project at year 15 or present worth of the project at year 0 and find A. Below are both methods
A = P (A/P, 7%, 15) = $4,130.50 (0.1098) = $453.53

A = F (A/F, 7%, 15) = $11,396.92 (0.0398) = $453.60

The 7 cents difference is due to round off errors.

PROBLEM #2: (15 points from 34) (20 points from 54)

1. Using Notepad, write a html document with the following design:
Background color: no red + very little green + lots of blue but not full blue
Text: Click on any shape to go to a different web site.
Image: blueshape.gif located at the subdirectory images of where the html file is located. The distance between any two yellow dots is 5 pixels.
The general shape of the image is:

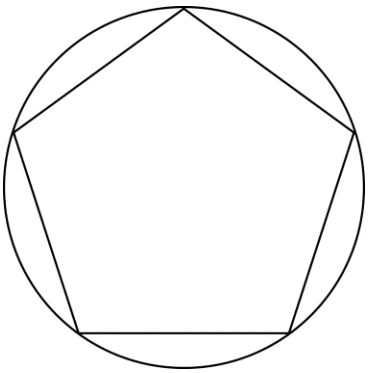


Solution:
The first thing that we need to do is to find the coordinates of the points needed for the map. For the polygon: (20, 5), (20, 25), (35, 25), (10, 50), (10, 95), (30, 120), (30, 80), (50, 80), (50, 20)

In the html document below, note that the image is in the images sub directory and the back ground color has no red (00), a little green (11) and lots of blue but not full (ee).

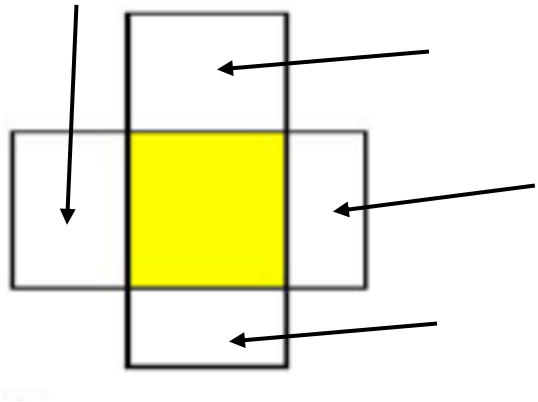
```
<html>
<head>
<title></title>
</head>
<body bgcolor="#0011ee">
<center><p>
<IMG SRC="images/ blue shape.gif " USEMAP="#exam2" BORDER=0 WIDTH=410 HEIGHT=370></P>
<p>Click on any shape to go to a different web site. </p></center>
<MAP NAME="exam2">
<AREA SHAPE=POLY
COORDS="226,38,238,35,261,62,269,61,267,38,279,35,280,43,272,48,273,67,260,68,238,47,226,45,226,38" HREF="http://www.handle.com/" ALT="">
<AREA SHAPE=POLY COORDS="20,5,20,25,35,25,10,50,10,95,30,120,30,80,50,80,50,20" HREF="http://www.yahoo.com/" ALT="">
</MAP>

</body>
</html>
```

Part 2
How to map a circle if you cannot use SHAP=CIRC? Since we can use polygon, then we can fit a polygon inside or outside the circle, then use the coordinates of the polygon to represent the circle.



3. You have two rectangles that are intersecting (like a + sign) and you want to map them. What is the main problem? How do you solve it?

The problem in here is the intersection area (yellow region). If we use SHAPE=RECT for both rectangles, then the browser will not know which links it has to select. To avoid confusion, we can use four smaller rectangles which do not intersect and assign no link to the yellow rectangle.



PROBLEM #3: (4 points from 34) (9 points from 54)

Write a complete C++ program that uses line and block comment, prints a hello world with a question mark, asks for the user to enter an integer number and prints that integer number again all on different lines.

```
// This is my line comment

/**

* This is my block comment

*/

#include <iostream>

using namespace std;

int main()

{

        int j;

        cout << "Hello World\?\n";

        cout << "Please enter an integer number and press return \n";

        cin >> j;

        cout << "You entered  " << j <<"\n";

        return 0;

}
```

7%	Compound Interest Factors					
	Single Payment		Uniform Payment Series			
n	Compound Amount Factor Find *F* Given *P* *F/P*	Present Worth Factor Find *P* Given *F* *P/F*	Sinking Fund Factor Find *A* Given *F* *A/F*	Capital Recovery Factor Find *A* Given *P* *A/P*	Compound Amount Factor Find *F* Given *A* *F/A*	Present Worth Factor Find *P* Given *A* *P/A*
1	1.070	.9346	1.0000	1.0700	1.000	0.935
2	1.145	.8734	.4831	.5531	2.070	1.808
3	1.225	.8163	.3111	.3811	3.215	2.624
4	1.311	.7629	.2252	.2952	4.440	3.387
5	1.403	.7130	.1739	.2439	5.751	4.100
6	1.501	.6663	.1398	.2098	7.153	4.767
7	1.606	.6227	.1156	.1856	8.654	5.389
8	1.718	.5820	.0975	.1675	10.260	5.971
9	1.838	.5439	.0835	.1535	11.978	6.515
10	1.967	.5083	.0724	.1424	13.816	7.024
11	2.105	.4751	.0634	.1334	15.784	7.499
12	2.252	.4440	.0559	.1259	17.888	7.943
13	2.410	.4150	.0497	.1197	20.141	8.358
14	2.579	.3878	.0443	.1143	22.551	8.745
15	2.759	.3624	.0398	.1098	25.129	9.108
16	2.952	.3387	.0359	.1059	27.888	9.447
17	3.159	.3166	.0324	.1024	30.840	9.763
18	3.380	.2959	.0294	.0994	33.999	10.059
19	3.617	.2765	.0268	.0968	37.379	10.336
20	3.870	.2584	.0244	.0944	40.996	10.594

Simple Interest:

Interest earned on amount P: $I = Pin$

Maturity value: $F = P(1+in)$

i = interest rate per time period

n = number of time periods

Compound Interest:

$F = P(1+i)^n$

F = future value

P = present value

i = periodic interest rate

n = number of periods

Ordinary Simple Annuity:

$$P = A\left[\frac{1-(1+i)^{-n}}{i}\right]$$

$$F = A\left[\frac{(1+i)^n-1}{i}\right]$$

A = periodic payment (end of period)

P, F, i, n as above for compound interest